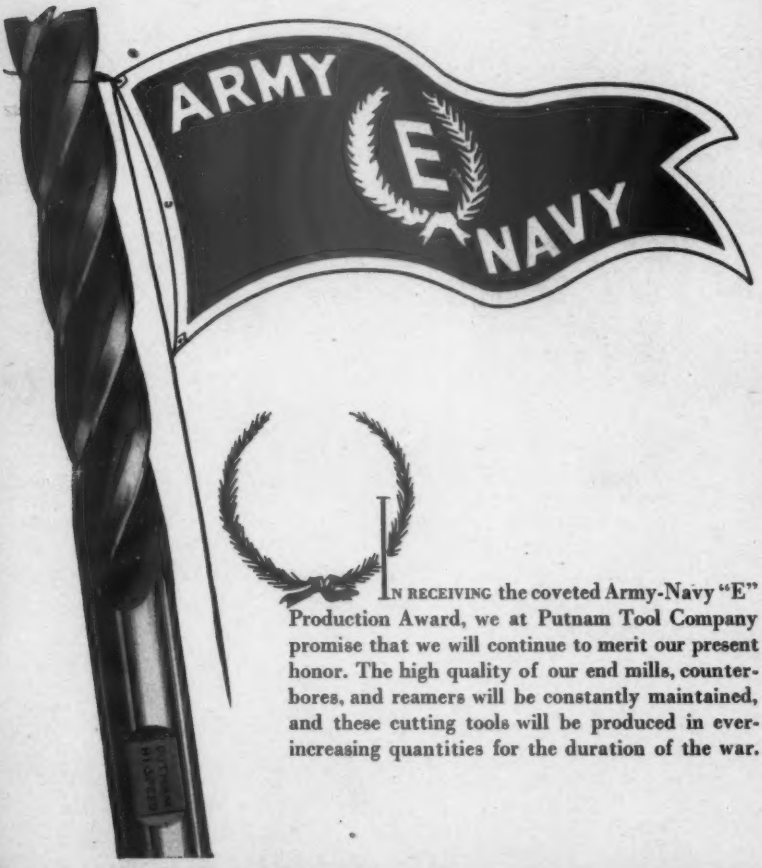
The TOOL & DIE Journal
Tool-Die-Machine PROGRESS

"For High Achievement"



IN RECEIVING the coveted Army-Navy "E" Production Award, we at Putnam Tool Company promise that we will continue to merit our present honor. The high quality of our end mills, counterbores, and reamers will be constantly maintained, and these cutting tools will be produced in ever-increasing quantities for the duration of the war.

PUTNAM *Hi-Speed* END MILLS

PUTNAM TOOL CO. • 2985 Charlevoix Ave. • Detroit

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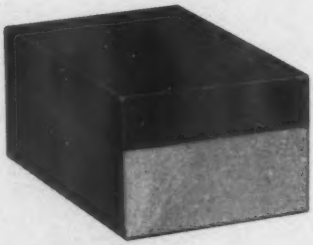

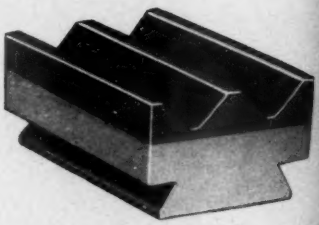

Dovetail forming cutters made from FCC Electrically Welded Composite Steel Blanks *(high speed steel cutting face; mild steel base)* save at least 50% of high speed steel. Besides, they offer other distinct advantages. Obvious among them are:—

1. **Non-hardenable, tough base minimizes tendency to crack and break out at sharp dovetail corners and screw holes during heat treating or when working.**

2. **Easier to drill and tap screw holes and machine dovetails in mild steel base; this work may be done *after* hardening if desired.**

3. **More prompt delivery because of reduced amount of high speed steel.**

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5. ***Marked saving of strategically important tungsten.***

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Extreme Accuracy, High Spindle Speeds and Ease of Operation

Extreme accuracy, high spindle speeds and ease of operation have multiplied many times the importance of Hardinge High Speed Precision Second Operation Machines.

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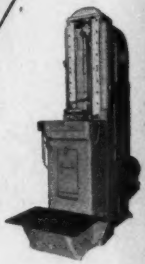
CLEVELAND, OHIO

Manufacturers of Small Arms Ammunition Tools

DESIGNERS AND BUILDERS OF TOOLS, DIES, JIGS, FIXTURES, GAGES AND SPECIAL MACHINERY

Banking on AMERICAN



for INCREASED PRODUCTION

Many producers of war materials have come to "Bank on American" for greater output. In these times of labor shortages it is imperative that maximum production be obtained with semi-skilled or unskilled help. It is significant therefore, when a single American Broaching Machine can often replace a battery of other machines and give equal production results.

The AMERICAN T-10-36 3-way type machine, shown at upper right, is arranged for surface broaching flats on the breech end of carbine barrels at a high rate of production.

The Machine shown at the left is an AMERICAN VP-4-25 ton 36" stroke vertical hydraulic broaching machine arranged for broaching two 1⅛" diameter holes 1-13/16" long thru tank track end connectors.

AMERICAN BROACH & MACHINE COMPANY

ANN ARBOR, MICHIGAN, U. S. A.

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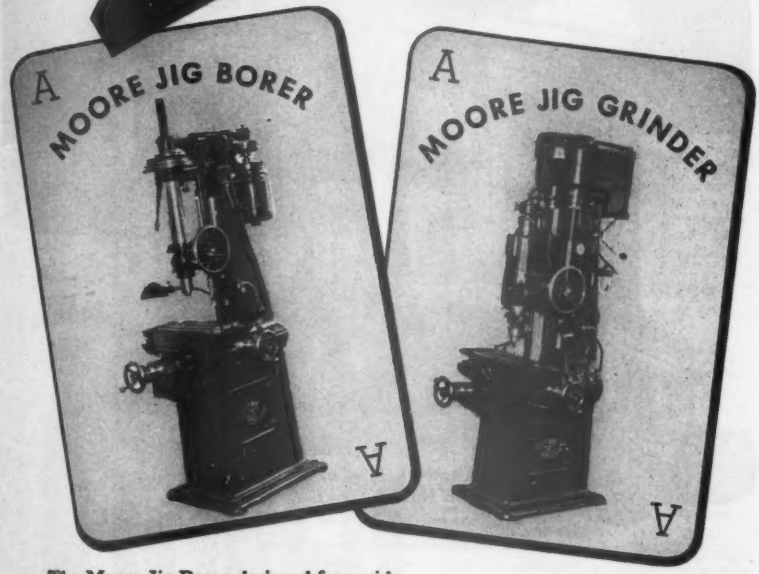
Division of ... MACHINE

2 TOOLROOM ACES...



The Moore Jig Borer, designed for rapid drilling, boring, reaming and checking operations, answers today's need for versatility and high precision in war production. Layout and jig boring problems will be efficiently solved with this simple-to-operate machine which is also used for jig-less small-lot production in many ordnance plants.

This new-type jig grinder corrects and finishes jig-bored holes in all kinds of tool work after hardening. Hole locations can be corrected within .0001" and may be ground straight, or tapered by hand or power feed. Speeds up checking and measuring.

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● MonoTractor with electric hoist on RailMaster heavy duty track system. Note use of bar for hook-up of slings to hoist hook.

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Write for Special Bulletin giving full details, prices and all specifications on this new DELTA-Milwaukee **Toolmaker** surface Grinder. Get in touch with nearest Delta Industrial Distributor or mail coupon direct to Delta Mfg. Co.

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CLAMPS

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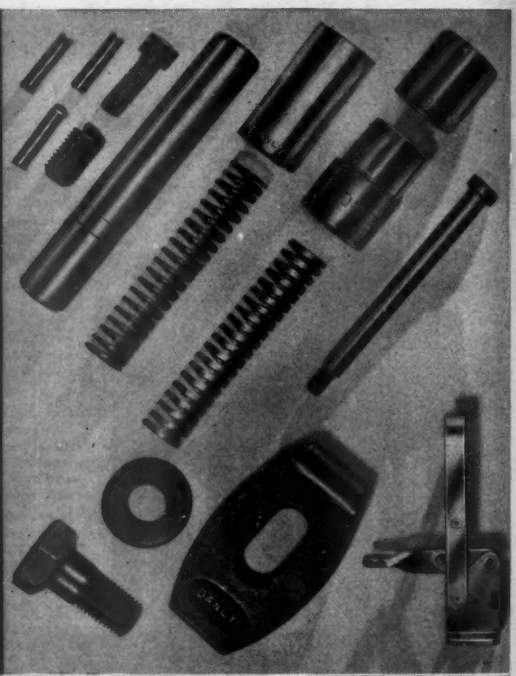

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WITH A PUNCH PRESS

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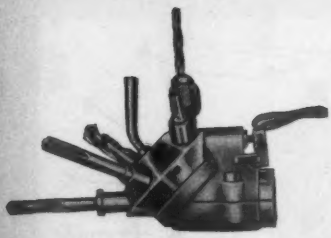
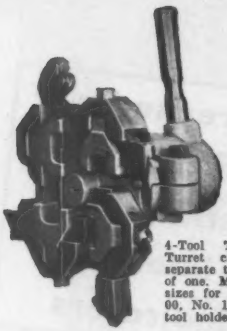


5-Tool Tail-Stock Turret accommodates five tools and each tool centers automatically when brought into position by means of an indexing plunger. Made in four sizes to fit small bench lathes up to lathes with 24″ swing.



4-Tool Tool-Post Turret carries four separate tools instead of one. Made in two sizes for standard 0, 00, No. 1 and No. 2 tool holders.

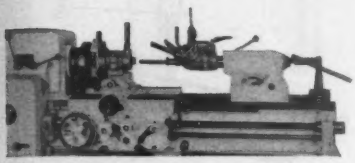
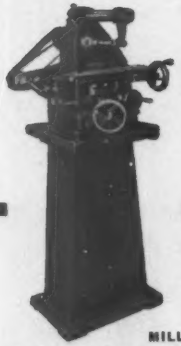


Photo above shows Jefferson Turret Attachments on 16″ Engine Lathe.



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This motor driven power feed precision milling machine is capable of close tolerances on die sinking, contour profiling, angular milling, jig boring, routing of ferrous, non-ferrous metals, fibre and plastics for production line or tool-room. Has 4 spindle speeds: 200, 400, 760 and 1000 R.P.M.—Write for details.

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in 15 seconds

Don't wait for Turret Lathes . . . You can convert any engine lathe into a complete precision turret lathe in 15 seconds with the Jefferson 4-Tool Tool-Post Turret, 5-Tool Tail-Stock Turret and Adjustable Pull Feed—and double its capacity. For forming, roughing, boring, finishing, drilling, tapping, etc.

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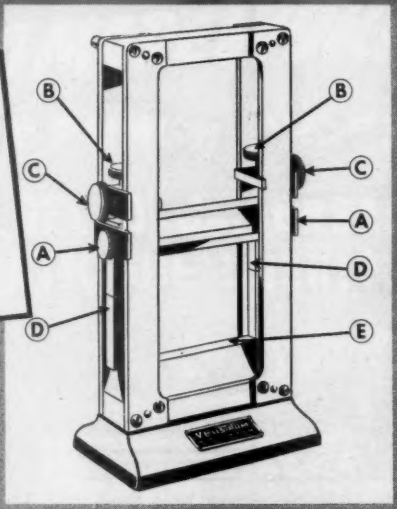

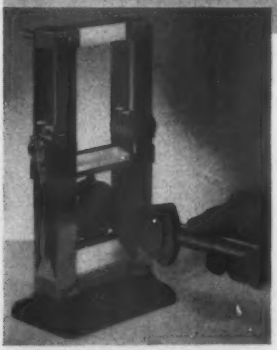

Above is a photograph of the Ellstrom Gage with the indicator being set at 3". To insure the ultimate in accuracy, each Ellstrom Gage is constructed of the finest steel with gaging surfaces that are processed and finished to millionths in flatness. For prices and delivery information wire or write today.

THE diagram drawing above shows the Ellstrom Gage set at 3" and the key explanation below gives the adjusting procedure.

Screws A on upper parallel bar have been carefully adjusted and need not be touched. In raising or lowering the bar loosen only screws C, then place fingers on screws A, and move bar upward or downward as the case may be, but without turning the screws.

Allow room to place the gage blocks on lower parallel between the posts of the gage. Then lower bar until its surfaces and those of the blocks fit snugly without any forcing. Tighten screw C lightly and evenly. Screws B are then used to apply slight pressure in making final adjustment.

D gage blocks E stationary parallel

Originators of Chromium Plated Gage Blocks

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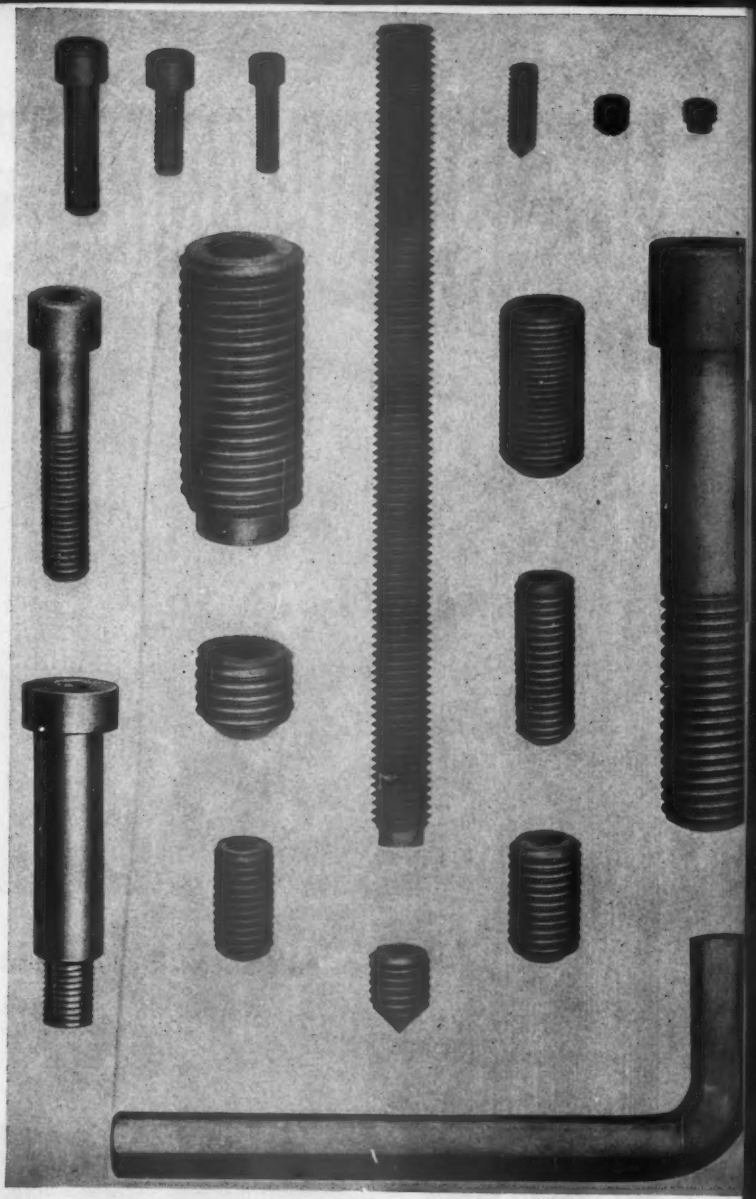

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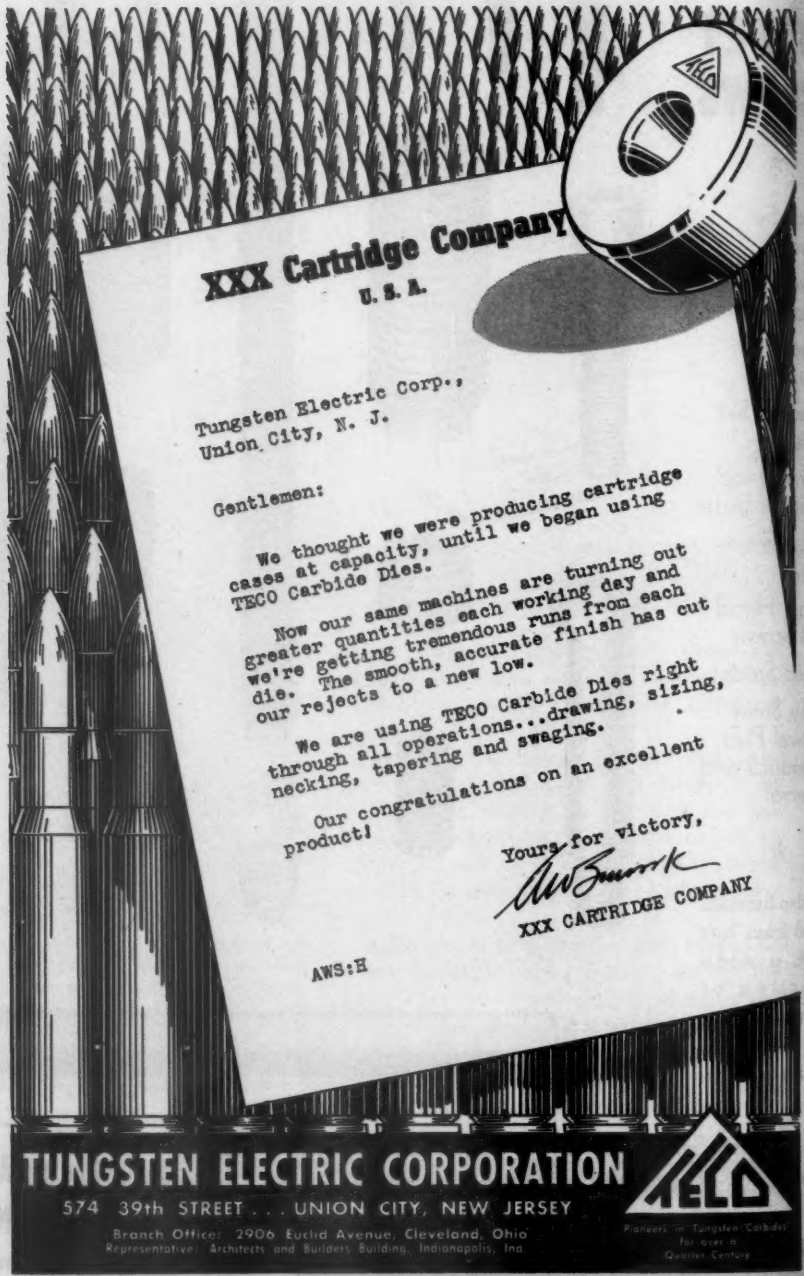
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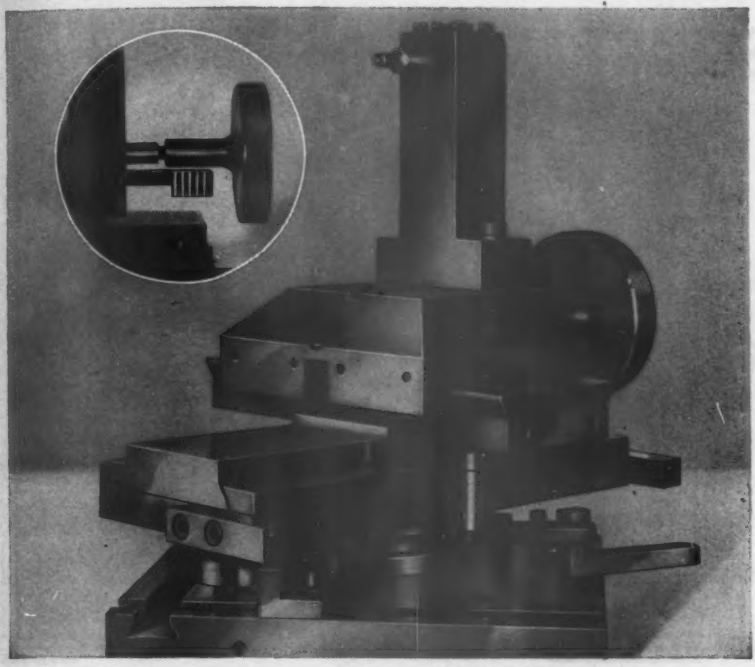
End "Check and Redress" . . .



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For fast, efficient, economical dressing of *radii, angles,* and *angles tangent* to *radii* on abrasive wheels — don't say an "angle tangent to radius dresser." Specify the KOPEC.

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See

SEBASTIAN LATHES

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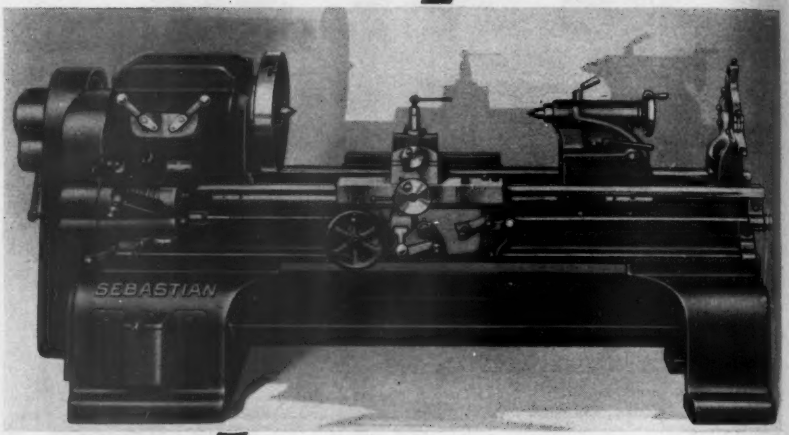

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2. Oversized heat treated, hardened and shaved steel gears in headstock assuring quiet operation.

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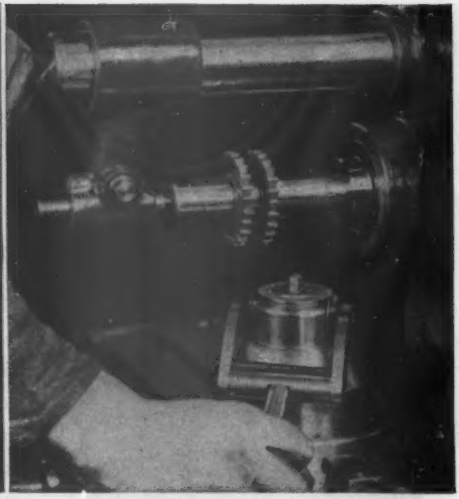

The Zagar Collet Index Fixture can be used on any standard milling machine to mill slots, hexes, keyways, punches, and taps and to perform many other operations.

FOR MILLING, DRILLING, TAPPING, GRINDING, AND SLOTTING

● The Zagar Collet Index Fixture can be adapted to practically any type of collet. It makes hexes, squares, slots, keyways, holes, et cetera. Two types — for holding and indexing or for holding only, each in 1″ and 2″ capacities. One handle opens, closes, and indexes. You can get any index division from 2 to 25. No chip trouble, since the oil comes up through the collet to lubricate and clean out. Easy to set up; extremely simple in design.

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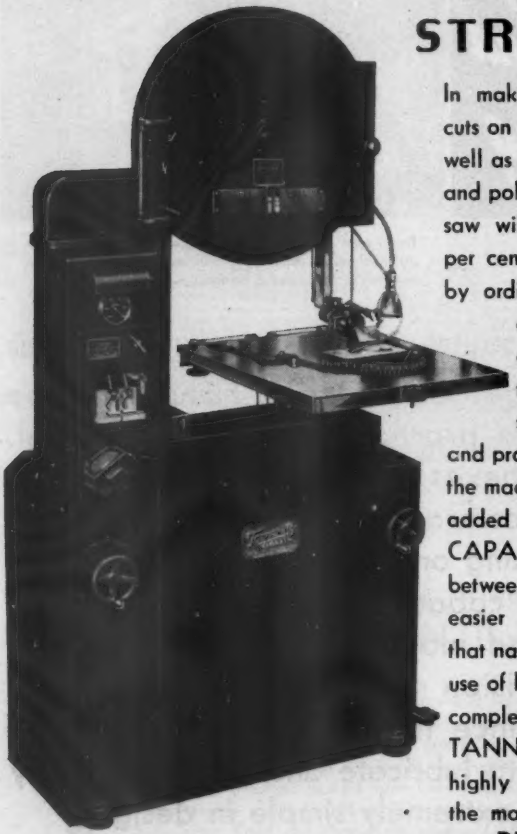
ZAGAR TOOL, INC.
23880 Lakeland Blvd. Cleveland, Ohio

Tannewitz DI-SAWS

have LARGER CAPACITY, saw *Easier*, STRAIGHTER



In making inside and outside cuts on dies, tools, jigs, etc., as well as inside and outside filing and polishing, the modern die saw will save upwards of 70 per cent of the time required by ordinary methods and reduce costs proportionately. Don't overlook this great opportunity to step up both production and profits. But be sure to get the machine that gives you the added advantage of EXTRA CAPACITY (a full 24 inches between the blades) and the easier and straighter cutting that naturally follows from the use of larger wheels. Get the complete facts concerning the TANNEWITZ M-24, the most highly developed die saw on the market. Simply write for our DI-SAW Bulletin. Also describes larger DI-SAWS for special applications.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

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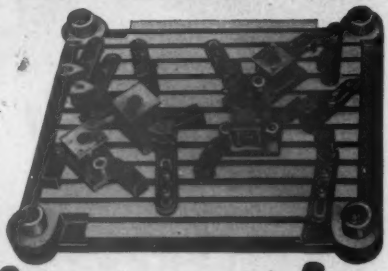
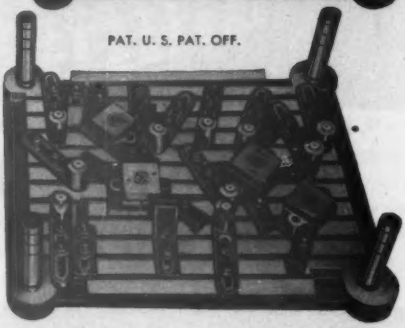
Adaptable to any type press for fast set-ups and quick change-overs on PERFORATING, NOTCHING and PIERCING operations.

Typical example of perforated and notched piece produced by a Whistler Adjustable Die Assembly.



PAT. U. S. PAT. OFF.

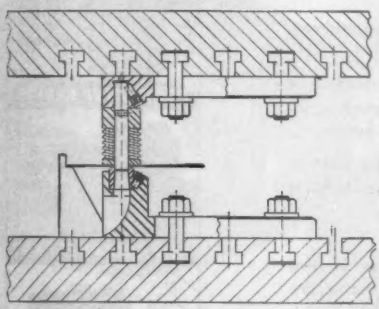


ABSOLUTE PRECISION

Once locked into position, die and punch holders "stay put." Compact design offers minimum perforating centers of ⅞ inch—more perforations in less operations. Full range of sizes for all types of work.

COMPLETE INTERCHANGEABILITY

Machined to tolerances of .0002" all parts are interchangeable. Can be quickly rearranged for different set-ups...often without taking out of the press.



Side view showing construction detail of a U-50, 0" to ½" Whistler Adjustable Perforating Punch and Die Assembly.

Whistler dies, tools and special machinery have been answering production problems—*for over 25 years, thru two wars*—in the nation's most important factories.

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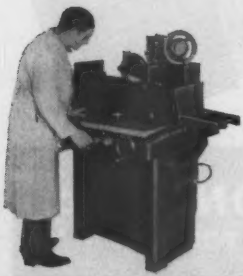
Surface grinding Plug Gauges, showing use of coolant.

"A NATURAL" IN WAR WORK PLANTS

- Read what the Plant Manager of one large midwest factory writes:

"Recently we installed one of your Surface Grinders. It has been operating on a 24-hour-a-day basis, grinding intricate and precise parts used on gun mounts and pumps.

"It is producing the finest work of all our grinders, both as to surface finish and accuracy. Production on the DoAll is *double that of any similar grinder* we have."



The DoAll comes in two sizes, adaptable to wet or dry grinding, with 7" or 10" wheel.

Send for literature giving construction features and other interesting data about these better grinders.

6 REASONS WHY THIS GRINDER IS THE BEST

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Dept. TD, Savage, Minn.

RIGHT ON THE NOSE!

Bomb-sights give American bombers the accuracy that enables them, in spite of speed, height and distance, to hit their targets "right on the nose".

What bomb-sights are to our fighting bombardiers, Micrometer Dials on Monarch Lathes are to the thousands of operators who are working furiously to build more and more planes for our Army, Navy and Marines. With these and other Monarch features, war workers save precious time and turn their jobs faster to the close tolerances required.

The rigidity and accuracy built into Monarch Lathes give them the stamina and dependability required for 'round-the-clock operation. They are helping our thousands of War plants to hit their Victory schedules —"right on the nose".

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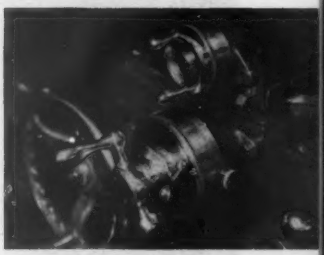

Proved accuracy of Micrometer Dials and Micro-Gauging Dials, large in diameter, with easy-to-read graduations in diameters instead of radii, save operator time, result in faster and more accurate production.

"Hogging work or finest finishing . . . we put our faith in Monarch Dials"

The Enterprise Tool & Mfg. Co., at Newark, N. J., produces jigs and fixtures as airplane subcontractors. They've used Monarch Lathes since 1929—with new ones added in 1934, 1940, 1941 and 1942. One of these new Monarchs produces twice as much of the same work as the lathe it replaced. The extreme rigidity and accuracy of these lathes enable them to do the heaviest hogging work or the finest finishing cuts with unvarying precision. To use their own operators' words —"Monarchs hit it 'right on the nose'."

MONARCH LATHES

COVER THE TURNING FIELD

PEERLESS SAWS SAVE TIME, METAL, BLADES

Today's Wartime savings and profits, invested in War Savings Bonds, will speed the Victory. And, the dollars you lend to your government will establish a fund for the new machines you'll need to "tool up" for peacetime operations.

Performance

Cutting SAE 105 shell stock, after piercing. The compensating, hydraulic feed safeguards the blade while cutting this 485 Brinell, hard, forged tube.

Peerless Saws help you buy more bonds by saving time, metal and blades on your sawing operations.

The Peerless Four-Sided Saw-Frame and Backing-Plate Blade-Support speed up metal cutting and the thin, cool-running, straight cutting Peerless Blade removes as little as 1/16" of the stock. Blade life is lengthened . . . cutting time is improved . . . and metal is conserved.

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SPECIALIZED SERVICES

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- Tool Designing
- Process Engineering
- Product Engineering
- Plant Layout and Routing for top efficiency
- Designers and manufacturers of dies, jigs, fixtures and special machinery.

Sure, we all know the change-over to war production creates many tough problems. Often it is necessary to retool and rearrange your normal production set-up.

But don't let it get you down, Mr. Arbuthnot. Just call in McKinney to lend you a hand.

Our twenty years' experience as industrial designers, engineers and plant layout specialists qualifies us to diagnose your operations "from the ground upward" . . . to gear your plant for maximum war-time efficiency.

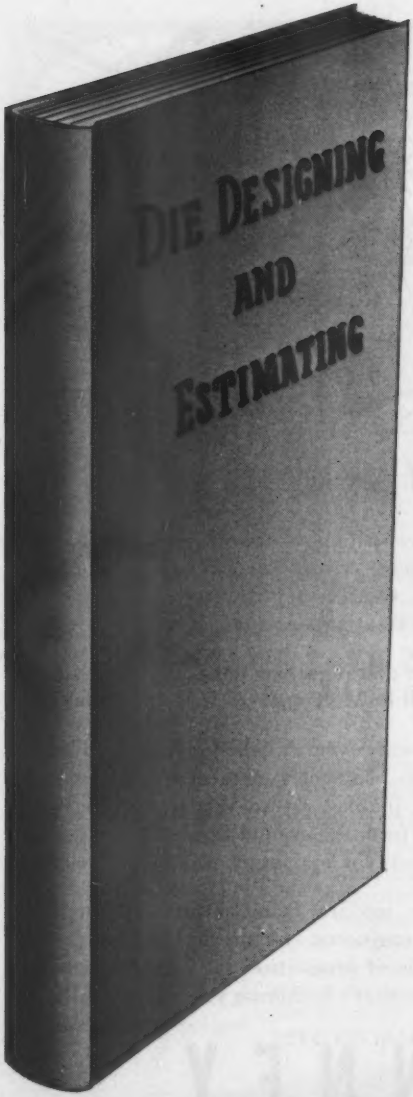
Because we are manufacturers, as well as design engineers, we are familiar with the problems of production . . . maybe with the very one that's bothering you, Mr. Arbuthnot!

McKINNEY

TOOL & MANUFACTURING CO.

1688 ARABELLA RD. CLEVELAND, OHIO

"DESIGN ENGINEERS FOR TWENTY YEARS"



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This book, largely written by specialists, is of timely interest today. It skillfully covers the subject of Die Designing and Estimating concisely, systematically and with authority. It is indeed the perfect book for the tool and die shop man!

Over 125 drawings, charts and photographs, carefully selected to illustrate modern die designing practice, are included. The estimating data is complete enough to follow from rough sketch to a final, sound estimate.

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PLAIN MILLING MACHINE

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SPEED, ACCURACY AND VERSATILITY
in
ARMAMENT PRODUCTION

PROMPT DELIVERY

Spindle is heat-treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings. Standardized flange spindle nose has No. 40 taper.
Controls for speed and feed are centrally located for ease of operation.

Table working surface	46"x10¼"
Longitudinal power feed	25"
Transverse power feed	9"
Vertical hand feed	19"
Max. distance spindle to table	19"
Number of geared feeds	16"
Range per spindle revolution	.005" to .212"

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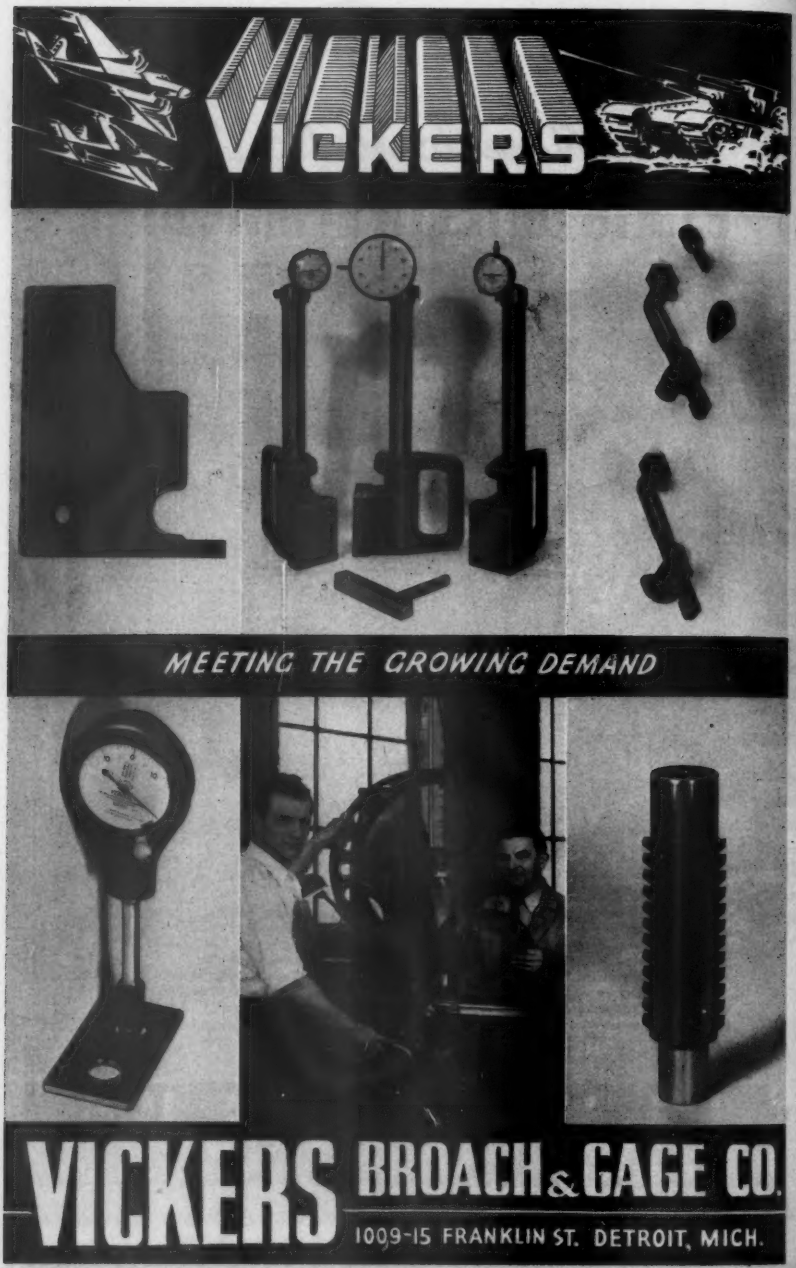
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MEETING THE GROWING DEMAND
VICKERS BROACH & GAGE CO.
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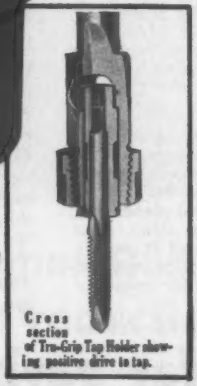
More Efficient Tapping at Lower Cost . . .

Here's why Procunier Tapping Heads give this to you



Cross section of Tru-Grip Tap Holder showing positive drive to tap.

The exclusive advanced design of the new Procunier Tapping Heads assures you accurate tapping at high speeds with automatic protection for taps! Tap is driven by a double-cone, cork-faced friction clutch which automatically regulates tap driving power by pressure applied through the drill press spindle. Operators can quickly detect dull or loaded taps by the "feel", or pressure on the clutch, required to drive them thus avoiding needless tap breakage. With this sensitive Procunier smooth-operating friction clutch, bottom tapping is as simple as through tapping, since the clutch instantly slips should the tap strike bottom or stick due to tap loading.

EXTERNAL THREADING

Standard Procunier Tapping Heads can be equipped for external threading. Produce accurate work and increase output.

Send for Bulletin

giving full details, description and prices on complete line of Procunier Precision Tapping Heads to meet all needs. The new Tru-Grip Tap Holder—and also the full line of Procunier Universal Tapping machines, hand or foot-operated.

Procunier Safety Chuck Co.
12-14 S. Clinton St., Chicago

Send me bulletins on: ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

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FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW

Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are making a definite contribution to Victory . . . by helping to buy guns, tanks, and planes that America and her allies *must* have to win. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month can buy when the war ends!

For Victory today . . . and prosperity *tomorrow*, keep the War Bond Pay-Roll Savings Plan rolling in *your* firm. Get that flag flying now! For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

SAVE WITH

EVERYBODY EVERY PAYDAY 10%

War Savings Bonds

This space is a contribution to America's all-out war program by
Staff of The TOOL & DIE Journal

Van Norman Receives Army-Navy Production Award

The star burgee was recently raised over the Van Norman plant in recognition of the company's outstanding output of vital war-production tools . . . ram-type, bed-type, horizontal, vertical, contour and hand milling machines . . . oscillating radius grinders for ball-bearing raceways . . . and automotive service machines. From now until the war is won, Van Norman *will continue* to earn this award, every hour of every day.

VAN NORMAN MACHINE TOOL CO., SPRINGFIELD, MASS.

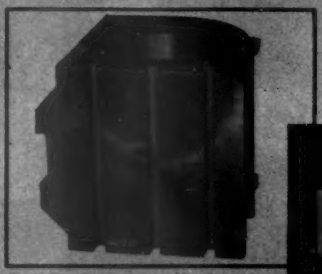
BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production
Adaptability
Fixture Saving
★ Operation Saving
★ Material Saving
Fine Finish
★ Flatness
★ Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

"PUT IT ON THE BLANCHARD"



Semi-Steel
Stock per side 1/8"
Limits ±.005"
square .001"
to .0015" in 16"

No. Sides 6
1 piece (6 surfaces)
1 hour and 35 min.

THE SHAPER TABLE, 15½" x 16" x 16", illustrated here, is an excellent example of large, heavy work which may be ground with ease on a Blanchard No. 18 Surface Grinder with 6-inch extended column. These tables come to the Blanchard as rough, semi-steel castings. Six sides are ground, ⅛" stock being taken off each side.

The BLANCHARD MACHINE COMPANY
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Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

To plant supts. This is one of a series of ads addressed primarily to new grinder hands. If you would like additional copies without our signature, for your bulletin board, tell us how many you need.

HOW TO GET BETTER AND LONGER SERVICE FROM GRINDING WHEELS

● Speeding production is only part of a grinder hand's wartime job. Basic materials must be conserved at the same time. With grinding playing so important a part in production, these simple rules may help you do both parts of your job better.

1 MAKE SURE THE GRINDING WHEEL IS CORRECTLY MOUNTED

To get the best service from grinding wheels, you must start with the right wheel and the correct set-up. Next it is important to make certain the wheel is properly balanced and correctly mounted. This must be done painstakingly to make sure it is in perfect balance and runs true without vibration or wobble. Where operators have difficulty doing this, they should ask their supervisors for instructions on proper balancing, truing and mounting procedure.

2 MAKE SURE THE GRINDING MACHINE IS IN GOOD CONDITION

The right wheel, the correct set-up and proper mounting are still not enough to insure long wheel life if the grinding machine itself is not in good condition. Bearings should be snug, foundations firm and every care taken to keep the machine as free from vibration as possible. The inspections and servicing necessary to maintain a grinding machine in tiptop condition will be paid for many times in longer wheel life, better work and higher production.

THE CARBORUNDUM COMPANY ● NIAGARA FALLS, N. Y.

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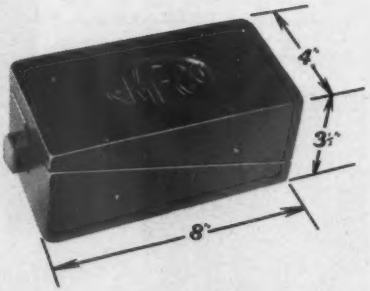
Every Machine Does its *LEVEL* Best

on EMPCO Jacks



Made in Three Sizes

3½" x 4" x 8"
2⅜" x 3" x 6"
2" x 2½" x 4½"

Only a level machine can operate at peak efficiency and give the maximum life that the manufacturer built into it. Empco Leveling Jacks assure a level machine on any surface. By turning a "hex" screw head, a level adjustment is obtained as precise as a micrometer reading.

If you have a leveling problem on any machine tool, write for illustrated literature.

Immediate Delivery

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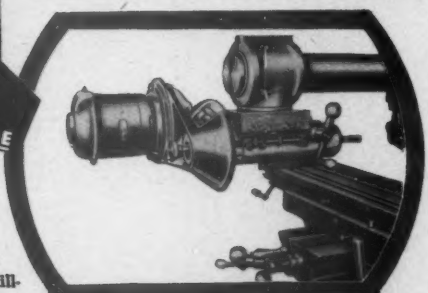
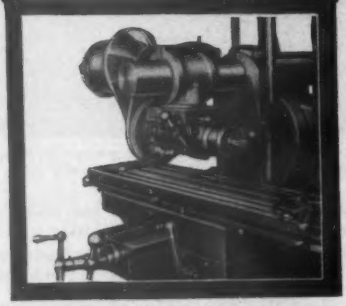
New HALCO UNIVERSAL HEAD

for High Speed MILLING, DRILLING, BORING and COUNTER BORING

Five Speeds 350 to 2900 R.P.M. Also 10 speeds 125 to 2900 R.P.M. available at no extra cost.

FOR HIGH SPEED MILLING, DRILLING, BORING AND COUNTER BORING ON ANY ANGLE





THE Halco Hi-Speed Universal Milling Attachment has proven its importance in building tools, dies, jigs, fixtures, wood and metal patterns and other machine products. Its 4-inch vertical travel permits many milling, boring and facing operations in one setup, a factor of convenience to which is added the advantage that the unit can be easily mounted by one man, it weighing only 90 pounds. Each head is unconditionally guaranteed for six months.

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Simplex Milwaukee Milling Machine—a compact, medium size machine for efficient production of smaller parts.

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CORPORATION

The machine tool industry has established new records in war production by producing machines in quantities without sacrificing accuracy and quality . . . Kearney & Trecker has developed many such machines, among them the M-Series Simplex — the newest machine in the bed type field.

It answers the demand for a medium-sized machine to efficiently produce the thousands of small parts vitally needed for planes, tanks and guns. Because its basic design is the same as the larger machines, it has strength and ruggedness to spare.

KEARNEY & TRECKER CORPORATION • Milwaukee, Wisconsin, U. S. A.

Milwaukee **MACHINE TOOLS**

The TOOL & DIE Journal
SEPTEMBER, 1942 Vol. 8, No. 6

Letter from Washington

By George J. Huebner

Labor Day, 1942

"OUR fathers brought forth on this continent a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal. Now we are engaged in a great . . . war, testing whether that nation or any nation, so conceived and so dedicated, can long endure . . . ."

Eighty years ago we fought a war to prove President Lincoln's words "that all men are created equal" and we proved that a nation "so conceived and so dedicated" can endure.

Today we are fighting another great war because our conception of liberty is that it is a right and privilege for all peoples in all nations and we intend to prove that, too.

President Roosevelt tells us that profound responsibilities are ours this day and every day. He says:

"This is indeed labor's grave hour as it is the grave hour of the farmer, the industrialist, the teacher and preacher, the aproned housewife, the smallest child in the cradle. All these are the beneficiaries and heirs of the democratic system, and it is democracy itself that the evil men of West and East hate and seek to destroy."

Although cooperation on the production front makes Labor Day, 1942, everyone's day, it belongs by precedent to Labor. It is fitting, therefore, that our tribute be for the man who works with his hands.

We have found no more significant words than those of one of America's largest employers, The Ford Motor Company:

"War work is rush work. We are all striving to do more than we are doing and do it faster. This eagerness creates tension, which often causes misunderstandings that are unimportant in the long run. Moreover, the workers have gone through troublesome times. Betterments gained have brought new and unfamiliar responsibilities. And when some minority somewhere gets out of line, you read about it in the newspapers.

"Unfortunately, the tremendous job being done by the vast majority . . . the millions of sincere, determined workmen who are fully conscious of their responsibility . . . does not always make the headlines.

"But rest assured, the work goes steadily forward . . . at an ever-increasing pace . . . and with millions of loyal workers on the alert, ready to eliminate from their ranks any with intent against the country's welfare.

"No other group has demonstrated greater understanding or greater willingness to set aside peacetime rights and privileges, than ninety-nine percent of the workmen in our shops. They know that the strong arms of American workmen are vital to victory.

"The job, indeed, will be done!"

The present urgent need for interchangeable precision parts for vital war products demands a constant gage check to insure product

Tolerance Control

By I. C. Ehlke
Chief Tool Inspector
Thompson Aircraft Products Co.
and Editors
D. E. Root
C. H. Haynes

THE success and low cost of mass production in essential war industries can be directly traced to America's perfected system of interchangeable parts manufacture and to Tolerance Control. Without carefully prescribed precision manufacturing procedures, the rapid assembly of integral parts of complicated mechanisms would be impossible. As specified tolerances for precision manufacturing become more severe, parts assembly rates increase and the service life of the finished product is lengthened.

Comparatively, it was but a few years ago that a tolerance of one-half of a thousandth of an inch presented a real problem for the average production plant. Today tolerance specifications in tenths of thousandths are regular procedure and the producer of airplane engine parts talks almost entirely in micro-inches, millionths of an inch.

With the advent of total war for the United States, the overwhelming need for aircraft forced that industry to apply mass production techniques to the building of high precision engines. The management of the Thompson Aircraft Products Company, quick to realize that a strict Tolerance Control was absolutely essential if maximum precision production results were to be achieved, promptly started what was destined to become a model method.

Two years ago Tapco established what was named its Tool Inspection Laboratory. Here were checked all new tools and gages coming into its plant from outside vendors. Today this Tool Inspection Laboratory is responsible for Tolerance Control throughout the plant. Its inspection and approval of both machine production and final checking gages insure practically perfect parts dimensions. The Tool Laboratory established a tool setting division which is responsible for accurately setting adjustable machine and production gages. The testing equipment, valued at $100,000, that has been built up since the laboratory's founding is but a fraction of the

money which has been saved in ultimate production costs.

One of the company's first actions was to adopt the Gage Makers' Tolerances of the American Society of Mechanical Engineers reproduced in table 1.

The class XX is precision lapped to extremely high standards and applies to Master Reference Gages.

The X class is also precision lapped and used in final checking operations for precision parts.

The Y class has a lapped finish and is used for working or machine gages.

The Z class of gages is not lapped but is finished ground to be used in general machine work. Class Z will not, however, meet the requirements of airplane engine parts production.

The second step in establishing Tolerance Control was the issuance of an order requiring that all new gages be actually marked O.K. by the Tool Inspection Laboratory before production could begin. Some of Tapco's gages are made in its own tool room but a large percentage are purchased from outside gage making specialists. Regardless of its source each gage must meet its specified *unilateral* tolerance. The adoption of *unilateral* tolerance control to replace bilateral in many production plants engaged in war products manufacture is due principally to the contention of the Ordnance Department that the unilateral tolerance system is more effective in its dimensional control of precision parts, thus assuring their perfect interchangeability and more rapid assembly. The distinction between unilateral and bilateral tolerances is graphically shown in Fig. 2.

Gages that meet all tolerance requirements are dated and released for use but this does not release the tool laboratory from continuing responsibility because all gages must be periodically checked to insure a constant dimensional control. This is particularly important in the scientific control of tolerances because some gages are used so frequently that it is necessary to check them every few hours.

Above	To and Including	(Male Gages Only) XX	X	Y	Z
.029	.825	.00002	.00004	.00007	.00010
.825	1.510	.00003	.00006	.00009	.00012
1.510	2.510	.00004	.00008	.00012	.00016
2.510	4.510	.00005	.00010	.00015	.00020
4.510	6.510	.000065	.00013	.00019	.00025
6.510	9.010	.00008	.00016	.00024	.00032
9.010	12.010	.00010	.00020	.00030	.00040

Fig. 1. Tolerance Table

As an example, on the final inspection of a precision part with a tolerance of plus or minus .00008, the gage is checked every 300 to 350 pieces. In an average eight-hour shift the inspector would gage 900 to 1000 pieces. This means that the gage is checked three times in one shift. On the other hand some gages, particularly those used following a machining operation, need to be inspected only once or twice a week.

The final inspection line uses as a gage check the F. R. piece, otherwise known as the factory register sample which is certain to have satisfactory dimensions. If the F. R. piece does not measure up to the original limits when checked, the operator knows that the gage is no longer accurate.

For gage setting, Tapco has established Tool Setting Departments in con-

Tolerances
Bilateral and Unilateral

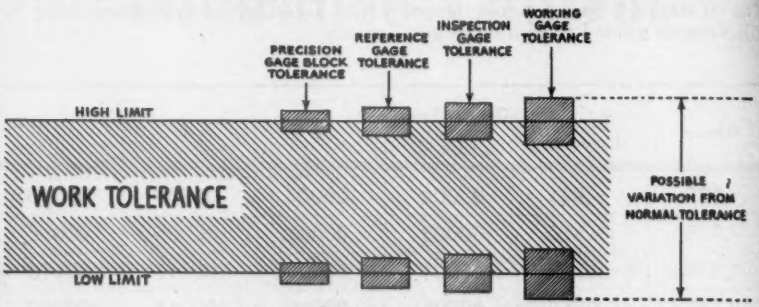
THERE is no such thing as an exact dimension. A dimension is only approximate within specified limits or tolerance.

By the same reasoning, there is no such thing as an exact tolerance, for a tolerance, like a dimension, is a measurable extent or magnitude. Consequently, it is necessary to conceive the idea of tolerances on tolerances for each step in transferring a measurement from precision gage blocks through the reference gage, the inspection gage and the work gage to the work part itself. The manner of locating these tolerances has been controversial for a long time.

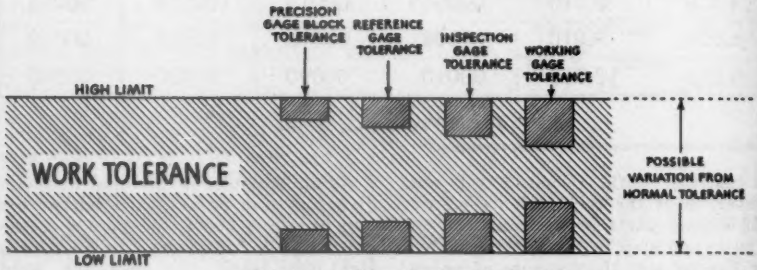
A bilateral tolerance is that wherein the limits, both high and low, bisect gage tolerance zones.

The unilateral tolerance is that wherein the limits entirely encompass all gage tolerances; that is all high limit gage tolerances negative and all low limit gage tolerances positive.

The bilateral system has been in use in this country for a long time and is probably adhered to at present for the majority of general commercial work. Ordnance engineers contend that the unilateral system is more scientific than the bilateral system and more effective in the production of precision work.



Tolerances as allocated by the bilateral system.



Tolerances as allocated by the unilateral system which is used on all United States Government ordnance work and on some commercial work.

Fig. 2 — Reproduced courtesy Sheffield Corporation

Fig. 3

Left—
Calibrating a standard Pratt & Whitney electro-limit measuring machine.

Right—
Checking a drill fixture with a Brown & Sharpe surface gage.

venient locations throughout the plant. The checking gages used in the Tool Setting Departments are in turn regularly checked by the central Tool Inspection Department which rounds out a perfect cycle of Tolerance Control. It has been suggested also, that "roving" checkers measure micrometer gages which are being used by machinists and toolmakers, thus insuring control over *all* gaging devices.

Tapco has found it necessary to purchase many intricate gaging instruments to insure the utmost accuracy in checking new gages and the master gages in the Tool Setting Departments. A few of these interesting gages are shown in Figs. 3 and 5.

The atmospheric conditions under which these master gages operate are ideal. Tapco has installed an air conditioned, vibrationless and sound proof testing laboratory in which a constant temperature of 72° F is maintained. The standard temperature in most air conditioned laboratories is 68° F or 20° C but Tapco has found, that when plant temperatures vary from 80° to 82°, gages checked at 72° give a much more satisfactory performance.

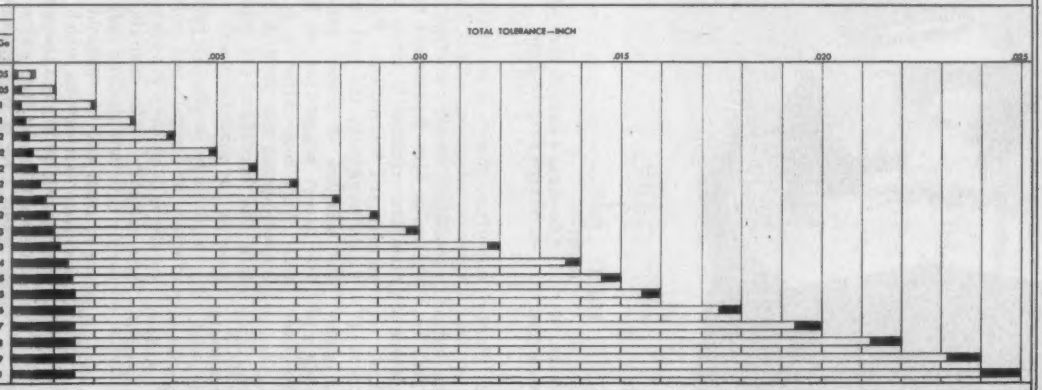
While the primary purpose of the Tool Inspection Laboratory is to control product dimensional tolerances, an equally important factor is to increase the life span of all gages. This has been accomplished through another kind of cooperation with department heads. Constructive criticism is given the tool designers and toolmakers. Production officials work with the tool inspectors in the selection of proper gaging devices and accept suggestions on their proper use. This cooperation is of particular importance at this time in order to obtain the maximum use built into the gage by the manufacturer.

Continually increasing precision manufacture of aircraft and ordnance items results in a steadily growing demand for new gages. Gage manufacturers can supply this new demand only if existing gages need not be replaced because of misuse or carelessness which usually are attributable to a gage operator's lack of understanding of the value of the instrument. Or a manufacturer may be responsible for careless handling of gages by not providing suitable and safe receptacles for them.

The training of gage operators under Tapco's training-within-industry program is especially thorough. They are taught the fundamentals of gaging and specifically the gaging operations for which they will later be held responsible. At Tapco, women have been found to be exceptionally well fitted for gaging op-

WEAR ALLOWANCES AND GAGEMAKERS TOLERANCES, PLAIN PLUG AND PLAIN RING INSPECTION GAGES INCLUDING PLAIN RING GAGES FOR MAJOR DIAMETER OF SCREWS, AND PLAIN PLUG GAGES FOR MINOR DIAMETER OF NUTS.

Component	Gage		
Total Tolerance	Wear Allowance	Tolerance Go	Tolerance Not Go
.0005	.0000	.00005	.00005
.001	.0001	.0001	.00005
.002	.0001	.0001	.0001
.003	.0001	.0002	.0001
.004	.0002	.0002	.0002
.005	.0003	.0002	.0002
.006	.0004	.0002	.0002
.007	.0004	.0003	.0002
.008	.0005	.0003	.0002
.009	.0005	.0004	.0002
.010	.0005	.0005	.0003
.012	.0006	.0006	.0003
.014	.0006	.0008	.0004
.015	.0006	.0009	.0005
.016	.0006	.0010	.0005
.018	.0006	.0010	.0006
.020	.0006	.0010	.0007
.022	.0006	.0010	.0008
.024	.0006	.0010	.0009
.025 & Up	.0006	.0010	.0010



GAGEMAKERS TOLERANCE, FLUSH PIN AND ADJUSTABLE SNAP GAGES.

.0005		.00005	.00005
.001		.00005	.00005
.002		.0001	.0001
.003		.0001	.0001
.004		.0002	.0002
.010		.0003	.0003
.015		.0004	.0004
.030 & Up		.0005	.0005

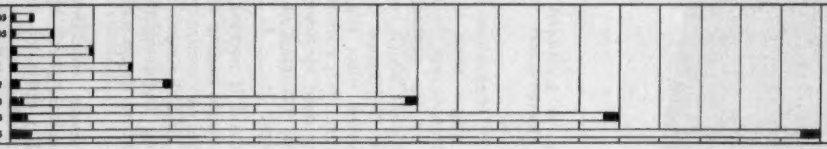


Fig. 4

This chart shows, both numerically and graphically, wear allowances and gagemaker's tolerances for inspection gages.

For component tolerances not listed, the next smaller tolerance shall be used.

The first four columns show numerical values, while the following portion of the table shows graphic values.

Column 1 shows the total tolerance on the product. Column 2 the wear allowance on the "go" gage.

Column 3 the tolerance on the "go" gage, and column 4 the tolerance on the "not go" gage.

There is no wear allowance on the "not go" gage because it wears toward the "go" gage and in the direction of safety.

erations since a delicate touch and an aptitude for details are necessary qualifications.

The operator is aided by special gaging fixtures, gage stands and racks. This speeds the gaging operation and at the same time lessens the possibility of injury to the gage. Designing these fixtures and stands is another step taken by the Tool Inspection Laboratory to increase gage life.

A certain amount of wear is to be expected in all gages even under the most ideal conditions. A gage is considered excessively worn in precision work, such as in the gaging of aircraft engine parts, when worn more than a half of one ten-thousandth of an inch. With certain types of fixed gages, particularly plug, ring, snap and similar perishable gages, it is advisable to have a film of oil between the piece and the gaging surface. It is interesting to note that the natural oil from the operator's hair, if wiped on the piece or gage surface, will appreciably reduce wear of the gage.

A convenient chart for determining wear allowance, prepared by the Sheffield Corporation, is shown in Fig. 4, as reproduced from the company's valuable publication, Dimensional Control.

At Tapco, perishable gages are not scrapped even after being excessively worn. They are ground an additional two thousandths of an inch under size and then hard chrome plate is applied by the plating department. With the plating process, it is possible to strip and replate a gage three or four times. However, more than four times is seldom desirable because the stripping process will roughen the original surface and the plate surface will reflect the irregularities.

Roughness on the surface of the gage will cause it to wear more rapidly, and consequently all new gages should be lapped with a surface variance of four to six micro-inches. This can be done with a 500 grit lapping wheel.

Intricate electrical or mechanical gages are repaired by an expert watchmaker who is employed full time in Tapco's Tool Inspection Laboratory. Considerable time and money have been saved and complete control over gage repair realized by this unorthodox procedure. A complicated gage mechanism, out of commission in the morning, is immediately repaired by the watchmaker and returned to service by afternoon. This type of ingenuity "Keeps 'em Gaging" at Tapco.

Fig. 5

Checking the location of a drill plate with the blueprint to see if the F. R. piece is according to specifications.

A Series — IX

Modern Milling Fixture Design

by C. W. Hinman
Designing Engineer

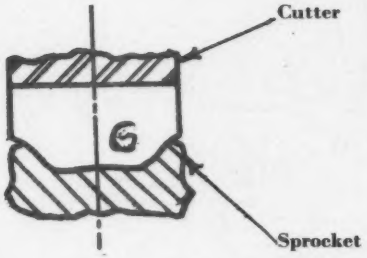
Formed Tooth Milling Cutters

FORMED tooth milling cutters are sharpened by grinding only the radial faces of their teeth, as shown at *F* in Fig. 49. The same amount of metal is carefully ground from the faces of each tooth in order to maintain the diametrical symmetry of the cutter. Formed cutters can be reground until entirely used up without changing the contour shape of their cutting teeth. This is due to the design of their teeth. Any radial cross section taken through them, as at *G*, always presents the same face and contour. Other milling cutters are ground on their tooth "lands" and thus become smaller, as explained in the previous article. Sketch *H* at point *J* shows the total cutting clearance at the heel of the formed tooth cutter. This clearance is produced by turning a spiral cut on the ends of the teeth as they pass the cutting tool in the lathe. A clearer understanding of the nature and utility of formed milling cutters is obtained when we know how and why they are so made.

Machining Formed Tooth Milling Cutters

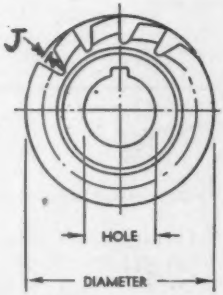
After the required number of teeth have been "gashed" and cut in a milling machine, the cutter blank is next "keyed" on an arbor in a lathe and the teeth are "backed-off" as at *J*. A straight lathe tool is used for making the backed-off cuts. The cutting contour of the lathe tool coincides exactly with the shape to be reproduced in work by the finished milling cutter. The lathe tool itself is also a certain type of formed cutter, that is, it can be ground on its top surface without changing the shape of its cutting edges. These types of lathe tools are called "flat form cutters". The lathe tool holder, with its cutter, is caused to reciprocate straight in and out by a controlling cam or by a rear attachment in the lathe. The tool must advance and back-off the face end of each tooth as the blank revolves and must then withdraw. Therefore, the number of cutting cycles of the lathe tool must necessarily be the same as the number of teeth in the cutter. In other words, the lathe tool withdraws in each tooth space that passes, and it advances while backing-off the ends of the teeth.

11 Teeth



Face of tooth coming

Fig. 49—Formed milling cutter for cutting teeth in block-chain sprocket wheels.



H

In concluding the subject of machining formed milling cutters: first, the cutter blank is turned in a lathe; second, the teeth are cut in a milling machine; third, the teeth are backed-off by using an attachment on a lathe and then the cutter is "smoothed", hardened, ground and polished.

Practical Applications of Formed Milling Cutters

One of the best known applications of formed milling cutters is for cutting involute gear teeth. They are, however, also widely used in cutting accurate shapes for parts used in army rifles, telephones, war tanks, airplanes and an infinite variety of other work. Formed cutters which are not standard shapes are of special designs and make-up. The cutting of gear teeth ordinarily involves spur, spiral, bevel and mitre gears. Spur gears have straight faced teeth across the blank as seen in Fig. 50. In spiral gears the teeth are cut spirally across the face of the blank. Bevel gear and mitre gear teeth may also be cut spirally. Bevel gears run at right angles to each other, but do not have the same number of teeth. Mitre gears are a pair of bevel gears, each with the same number of teeth. In both bevel and mitre gears the center lines intersect at right angles.

In extremely large or small gears the comparative number of teeth varies so widely that the shape of the cut between the teeth, on different diameters, is also affected. As a result, standard involute shapes of gear cutters are made in different numbers. The numbers range from 1 to 8 inclusive and cover different discrepancies in gear cutting from 12 teeth up to 135 teeth and a straight rack of teeth. For cutting accurate gears, special formed cutters, called "single purpose" cutters, are made. Gear cutters made in the half numbers can also be obtained.

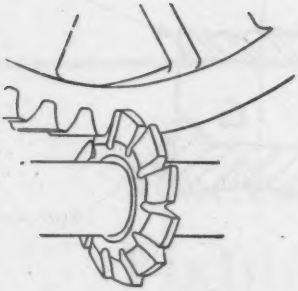


Fig. 50 — Setup in which a formed involute gear cutter is cutting the tooth spaces between the teeth in a large spur gear.

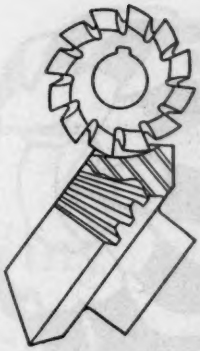


Fig. 51 — An indicated setup for milling teeth in mitre or bevel gear blocks using a formed tooth involute gear cutter.

Cutting Mitre and Bevel Gear Teeth

Fig. 51 is a vertical cross sectional view through a bevel or mitre gear in which one of 25 teeth is being cut with an involute gear cutter. Fig. 52 shows a photographic reproduction of the milling fixture with the gear mounted and clamped on an automatic indexing stud. The stud and gear blank are indexed by the operation on an electrical switch. The operation here is for the "roughing" cut, and the finished gear is used in the mechanism of a combat aircraft assembly.

How to Select the Milling Machine

Selection of the proper milling machine for rigid and accurate performance in the mass production of work for interchangeable parts is even more important than designing good holding fixtures. A rigid holding fixture used in an inferior milling machine, which may be too flexible, defeats the purpose of both the tools and fixture. Illustrated is a Brown & Sharpe No. 12 Plain Milling Machine, specially designed for manufacturing parts in mass production. Its principal features are: double overarm support for the arbor and cutters; individual motor drives for the spindle and feeds; automatic lubrication; adjustable dials for spindle adjustment; full electrical control of the table movements; and extra heavy and sturdy construction.

(Drawings, courtesy Illinois Tool Works)

REPRINTS

"Typical Designs for Drilling Jigs and Fixtures" by C. W. Hinman, a series in six parts, has been reprinted by popular demand. Copies may be secured by writing The TOOL & DIE Journal, 2460 Fairmount Blvd., Cleveland, O. Price, 25c per copy.

Fig. 52—Milling fixture with a bevel gear mounted on a stud for automatically indexing and cutting 25 involute gear teeth. This picture clearly shows the intimate relationship between the arbor, cutter and the work which produces accurate cuts.

As Military Manpower Needs Increased, Major General Hershey requested all industrial executives to

Take An Inventory Now

By Major General Lewis B. Hershey United States Army Director of Selective Service

MANPOWER is a most important strategic material of today. Every employer should make a prompt inventory, appraisal and analysis of the manpower in his own plant as he would inventory his stock pile. In order to keep production going and at the same time furnish men for the armed forces, industry should now establish an orderly replacement program.

In order to secure temporary deferments for essential men while he is training women, young men, older men, men physically handicapped or those with a high degree of dependency, the employer should know the fundamental principles in the operation of his local Selective Service Board. Certain steps should now be taken by each employer. He should know how many men on his pay roll are between the ages of 20 and 45. He should investigate the classification of every one of those men. On the basis of such an inventory he should prepare to plan ahead and train men for replacement of those who must necessarily enter the armed forces if we are to have the sort of army which can win the war.

Deferments Temporary

Deferments, granted so that employers may train women or men not liable to early induction, are temporary deferments; they cannot exceed six months and in many cases may be for only thirty, sixty or ninety days. The Army today has to train a bomber pilot within a period of eight months to operate a very technical machine with an instrument board which puzzles an expert. Why, therefore, should industry insist that it assume that it can take two or three years to train men for industrial tasks not nearly so complicated?

The fundamental purpose of every deferment of a registrant is to allow an employer to train a replacement. Only in a few rare instances can an employer expect to have these temporary deferments continued for more than the six months' period. These are only in cases where an abnormally long period of training is required for a replacement and the eight months needed in which a bomber pilot can be turned out now is something to remember in this connection.

Employer's Responsibility

Employers may seek the deferment of their necessary men with or without their consent.

Here is how they go about it.

On page 3 of the Selective Service Questionnaire (Form 40) which is sent to each registrant before he is classified is the following:

INSTRUCTIONS.—IF YOUR EMPLOYER BELIEVES THAT YOU ARE A NECESSARY MAN IN A NECESSARY OCCUPATION, IT IS HIS DUTY TO FILL OUT FORM 42A REQUESTING YOUR DEFERMENT. YOU MAY ALSO ATTACH TO THIS PAGE ANY FURTHER STATEMENT BY YOURSELF WHICH YOU THINK THE LOCAL BOARD SHOULD CONSIDER IN DETERMINING YOUR CLASSIFICATION. SUCH STATEMENT WILL THEN BECOME A PART OF THE QUESTIONNAIRE.

This is on all the questionnaires distributed during the past six months. The fact that the Selective Service System now specifically mentions the filing of Form 42A as the manufacturers' duty is a clear indication of the Selective Service System view on the responsibility of each employer in this matter.

The employer can secure Form 42A at the local board and the local board will consider the employer's request when the form is properly filled out and signed.

If such request should be denied because the man, after consideration of the claims offered for him, is not considered to be indispensable to the company's operation, and is needed more in the armed services, the local board will advise the employer of its refusal of such an occupational deferment.

The local board does this by sending to the employer, at the same time it notifies the registrant of his classification, a Form 59.

May Make Appeal

There are ten days after Form 59 is mailed by the local board to the employer during which the employer can appeal the registrant's case.

The registrant will not be ordered to report for induction during this ten-day period.

In order to make an appeal the employer simply has to sign his name to Form 59 which he has received, and return it to the local board; or in case the Form 59 is not received from the local board, any written request will have full value to make such an appeal effective.

When Form 59 is returned by the employer the appeal procedure becomes automatic.

All necessary forms are available at the local board in the employer's immediate vicinity or at the office of the State Director of Selective Service.

If the local board and the appeal board deny the appeal for the occupational deferment of a key man, the employer may then bring the matter to the attention of the State Director at the State Selective Service Headquarters, with the request that the case be reopened or appealed by him to the President.

Definite Duty

A double duty rests upon the employer. He should personally know what his manpower situation is. He should not leave the job to a minor employee to decide who is necessary. The employer who delegates the task of filing a request for deferment to a clerk, the executive who does not make a complete inventory of his whole plant today, is negligent. Likewise, the employer who files requests for deferment of men who can be replaced by women, or others, is keeping reinforcements out of an Army which is battling for us all. The employer engaged in essential war production who has been required to greatly expand his plant and who then fails to request deferment for his key men is also negligent.

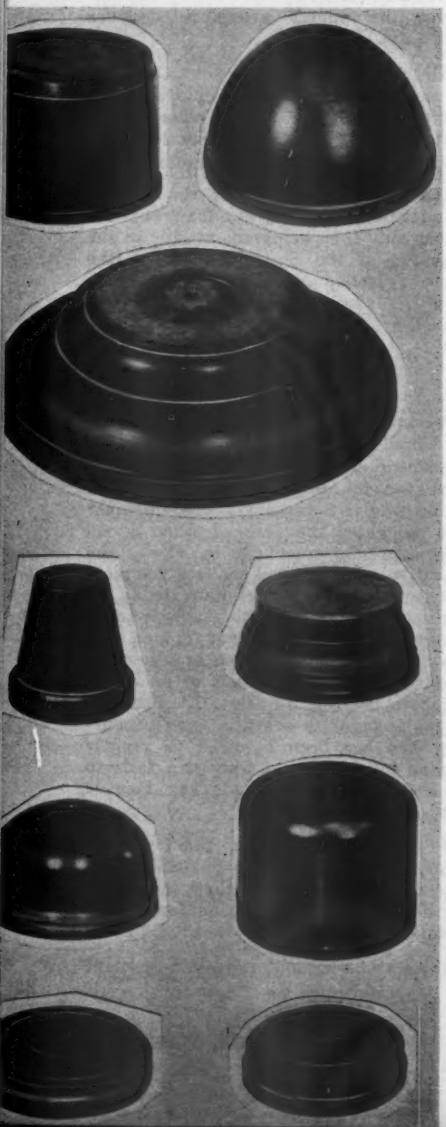
A good rule to follow: Don't ask deferments for any men who can be replaced by training another individual not likely to be eligible soon for service in the armed forces.

Make an inventory, request deferment

(Continued on Page 123)

Joining America's all-out production program is Industry's use of

Plastic Dies



THE joint efforts of the aircraft and automotive industries in producing planes by mass production techniques have uncovered some "fairy stories" in speed that are deadly practical.

One such story is the "Magic of Masonite", a semi-plastic material used in the manufacture of dies for shearing, forming and spinning sheet metals; router templates; drill jigs; and assembly fixtures.

Easy to handle—six times lighter than steel—there is no need for cranes or special equipment in transporting or installing these dies, jigs and fixtures. With stiffness and strength for production runs, yet easily handled by pattern or tool makers, Masonite Die Stock is giving aircraft manufacturers an all around economy of time, money and effort.

While its most spectacular success is being demonstrated in the aircraft industry, Masonite Die Stock is also being used by other manufacturers for its light weight and high compressive strength. This modern material produces a type of die which does not scratch the metal or cause surface imperfections. When used to fabricate a fixture, it can be drilled and tapped for attaching clamps and gages.

Many companies are on the alert for new materials to replace scarce metals. The aircraft industry offers these pictures as a solution to one of their problems.

Masonite Form Block used in construction of wing spars at Bell Aircraft Corporation.

Deep draw die made of Masonite Die Stock to produce landing gear wheel pocket at Grumman Aircraft & Engineering Company.

Masonite Router Dies in operation with Radial Arm Router. Photograph courtesy of Vought-Sikorsky Aircraft Div., United Aircraft Corporation.

Masonite Die Stock used in fuselage assembly fixture for Curtiss-Wright Corporation's "Troop Ship of the Skies".

The Adseco Process saves Prime Contractors valuable man hours in making precision

Template Duplicates

E. A. Pogalies

Charles Weber

AMERICAN Industry has accepted the responsibility of building war materiel in sufficient quantities to defeat our enemies. Every possible machine and engineering facility must be commandeered if this is to be done. For the past several years, the Ad Service Engraving Company, Cleveland, Ohio, has been developing a process that will aid in relieving the bottlenecks in engineering and designing departments. This development is known as the Adseco Process for accurately duplicating templates.

To make a template from a blueprint calling for tolerances of .001 has always been a slow procedure, but the saving realized once the template was completed made the effort worthwhile. With the increased demand on war industries, many template users had an urgent need for duplicate templates to facilitate subcontracting. Means of duplicating templates were tried, but few were successful if rigid tolerances were required. Making duplicate templates from the original was a valuable contribution to industry. It must be pointed out, however, that accuracy is sacrificed and it should not be attempted if a tolerance of more than .025 is required. Photographic techniques were also tried but camera distortion on high precision work caused error too great for practical use.

The Adseco Process satisfies the severe tolerance requirements demanded by the Machine Tool and Aircraft Industries. This new method uses a simple engraving process to achieve the desired results. Skilled draftsmen lay out the specifications, as given on the blueprint (See Fig. 1) directly on a special coated glass (Fig. 2). A razor edged instrument cuts lines so fine that magnification is necessary to accomplish this work. Fig. 4 shows the contrast between pencil, pen and the razor edged tool used in the Adseco Process.

Many "tricks" have been devised for using precision instruments on glass. When a center point is found, a small piece of scotch tape is pasted over this point so that the beam compass cannot slip when an arc is scribed. A steel rule is also secured by scotch tape to be used as a base line. Vernier calipers are used to check all dimensions. At the

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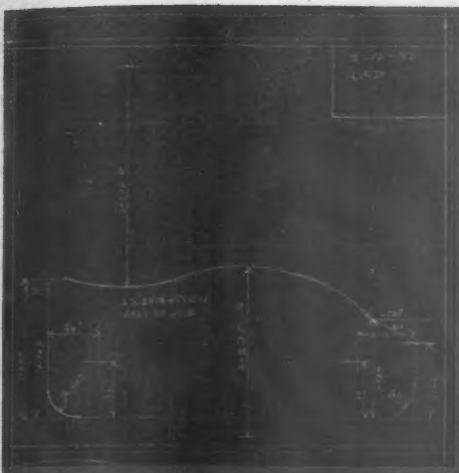

Fig. 1 — The original blueprint of a template which is supplied by the manufacturer and from which specifications are taken to make an accurate drawing.

Fig. 2 — The accurate drawing on glass showing the center points from which the ares are scribed. Note the fine lines which result in a template accuracy of less than .005.

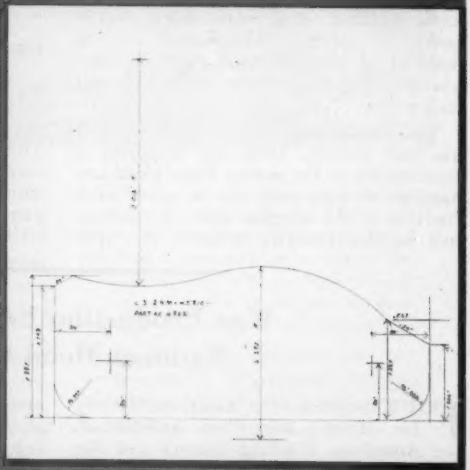

Fig. 3 — The template is shown after being transferred by the Adseco Process to the steel.

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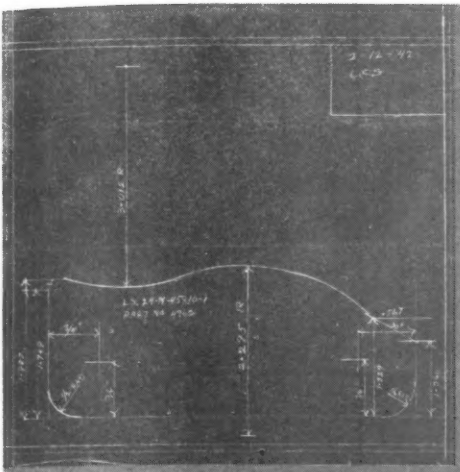

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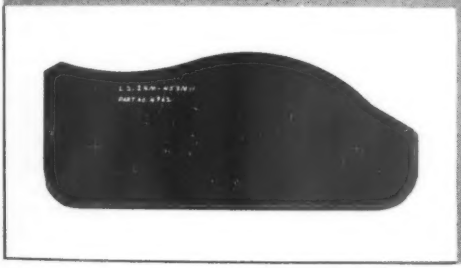

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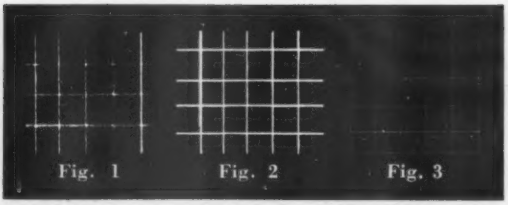

Fig. 4

Fig. 1-a — Reproduction of Pencil Line

Fig. 2-a — Reproduction of Ink Line

Fig. 3-a — Reproduction of Razor Edge Line Adseco Process

present time, two men working as a team can lay out a template on treated glass in about six hours. This time will vary according to the nature of the job. A reverse print is then made on a second piece of glass before final transmission to the steel. This step is necessary to reverse all lines and lettering so that the final step can be reproduced on the steel with a solid blue background broken only by the light dimension lines of the template. (Fig. 3.) Each line is slightly etched so if the blue enamel should become defaced, they can always be located by touch. The enamel can be washed or cleaned with gasoline—only alcohol or a sharp instrument will mar its surface.

The advantages of the Adseco Process are self evident. Once the blueprint is transferred to the coated glass plate any number of templates can be made at a fraction of the original cost. A machine tool builder recently ordered 19 duplicate templates. Six hours were consumed in making the layout and then the 19 templates were as easily made as one would have been. Several aircraft engine and airplane manufacturers are already utilizing the Adseco Process and saving man-hours as well as releasing their machines for urgent production. This example of an engraving process solving a "tough" problem for the metal working industry should inspire other non-war industries to adapt their activities to war production.

For further information on the Adseco Process write Template Products Division, Ad Service Engraving Co., 1440 Chester Ave., Cleveland, O.

War Production Edition of the National Metal Congress

FOUR societies—the American Society for Metals, the Wire Association, the American Welding Society and the American Institute of Mining and Metallurgical Engineers, Iron and Steel and Metals Division—will present over 100 technical papers at the 24th annual Meeting of the National Metal Congress. In addition to the technical sessions, outstanding authorities in government and industry will speak at 25 special War Production Sessions which will deal with the more urgent and timely topics of increasing production of war goods.

W. H. Eisenman, managing director of the Exposition, said, "These sessions will be practical, operating on a give-and-take basis with metal men getting answers to their problems and contributing to to the solution of others. The theme of the entire Congress—'Increased Production of War Products'—will be emphasized at these experience-pooling sessions."

Two hundred and fifty manufacturers have now reserved 95% of the space available in Cleveland's Public Auditorium, with all indications that these companies will feature educational and consulting services in their displays. With hundreds of manufacturing experts on hand, every effort will be made to help visitors increase their production of war goods.

Do you realize what your own Distributor is doing to help you keep going today?

Your Industrial Supply House' big, modern Catalog is just as vital to your Purchasing Department as:

—your marketing records are to your Sales Manager

—accurate credit information is to your Accounting

—Production Charts and Cost Sheets are to your Management Executives

—because it provides one indispensable, central point for locating whatever you need in plant equipment and supplies.

Each of these big books may list 15,000, 25,000 or even more separate items—the Distributor normally carries many thousands of them in stock for immediate delivery to you.

Your Distributor has facilities and a trained staff to give you *specialized service*—he is in constant touch with scores of manufacturers producing every kind of plant machinery or supplies. He frequently can help your Purchasing Department to locate and expedite the materials you need most to keep your production schedules rolling.

Take the Mill Supply Distributor into your "Company family." He will quickly earn *your* respect and confidence just as he has earned ours.

Because for many years, Industrial Supply Houses have been our Representatives in selling Cle-Forge High-Speed Drills and Peerless High-Speed Reamers throughout the United States.

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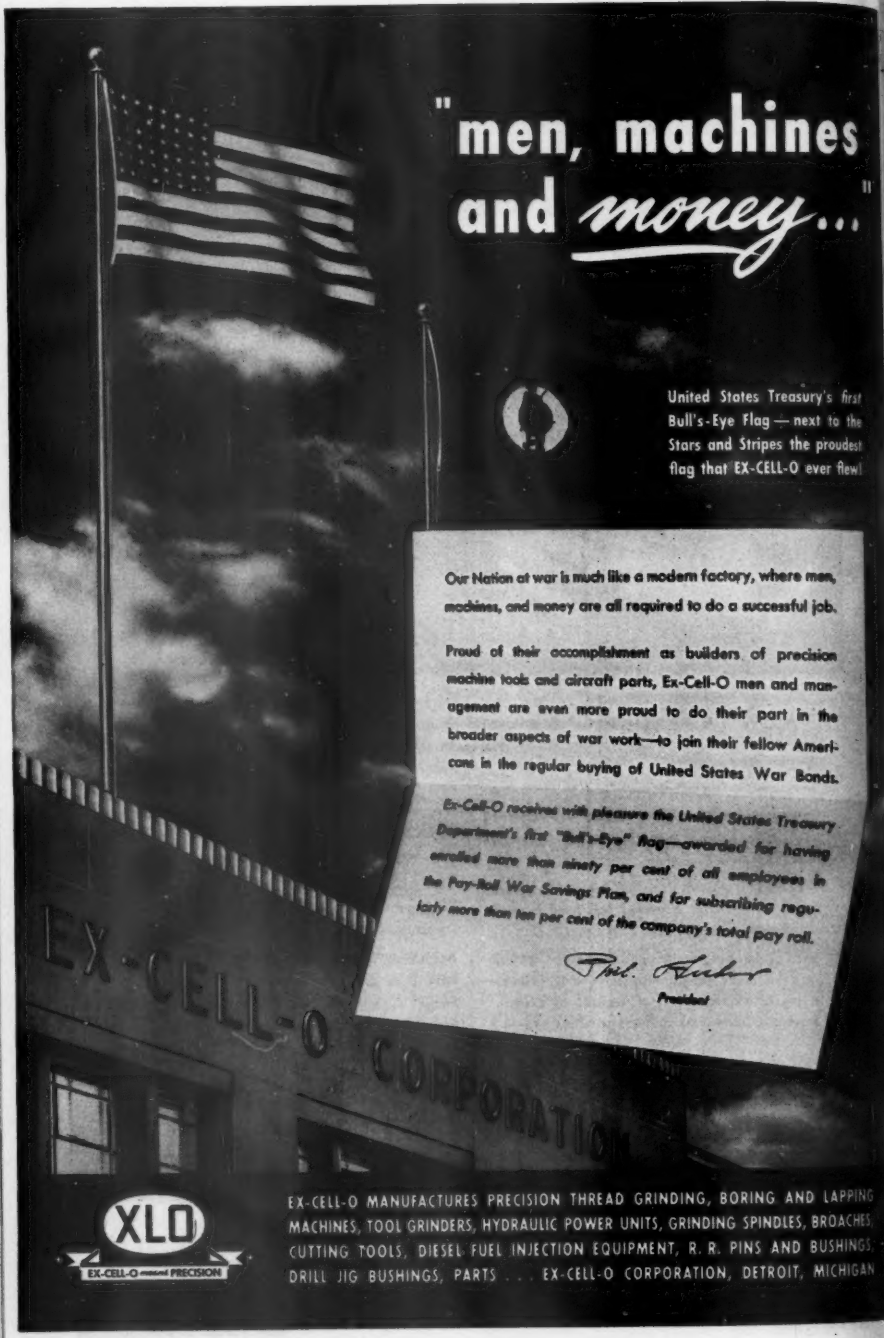

"men, machines and money..."
United States Treasury's first Bull's-Eye Flag — next to the Stars and Stripes the proudest flag that EX-CELL-O ever flew!
Our Nation at war is much like a modern factory, where men, machines, and money are all required to do a successful job.
Proud of their accomplishment as builders of precision machine tools and aircraft parts, Ex-Cell-O men and management are even more proud to do their part in the broader aspects of war work—to join their fellow Americans in the regular buying of United States War Bonds.
Ex-Cell-O receives with pleasure the United States Treasury Department's first "Bull's-Eye" flag—awarded for having enrolled more than ninety per cent of all employees in the Pay-Roll War Savings Plan, and for subscribing regularly more than ten per cent of the company's total pay roll.
President
EX-CELL-O CORPORATION
XLO
EX-CELL-O means PRECISION
EX-CELL-O MANUFACTURES PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DIESEL FUEL INJECTION EQUIPMENT, R. R. PINS AND BUSHINGS, DRILL JIG BUSHINGS, PARTS . . . EX-CELL-O CORPORATION, DETROIT, MICHIGAN

CONSERVE CRITICAL MATERIALS— GET BETTER RESULTS

with "THE VICTORY STEEL"

Graph-Mo Steel will outwear competing oil-hardening tool steels and will machine at least 25% faster than competing steels.

Now add to this the saving in critical materials that is obtained from the use of Graph-Mo Steel and you will understand why it deserves to be called "The Victory Steel."

As revealed in the chart below, Graph-Mo uses no Chrome, no Vanadium, no Tungsten, no Manganese, and only .25 Molybdenum.

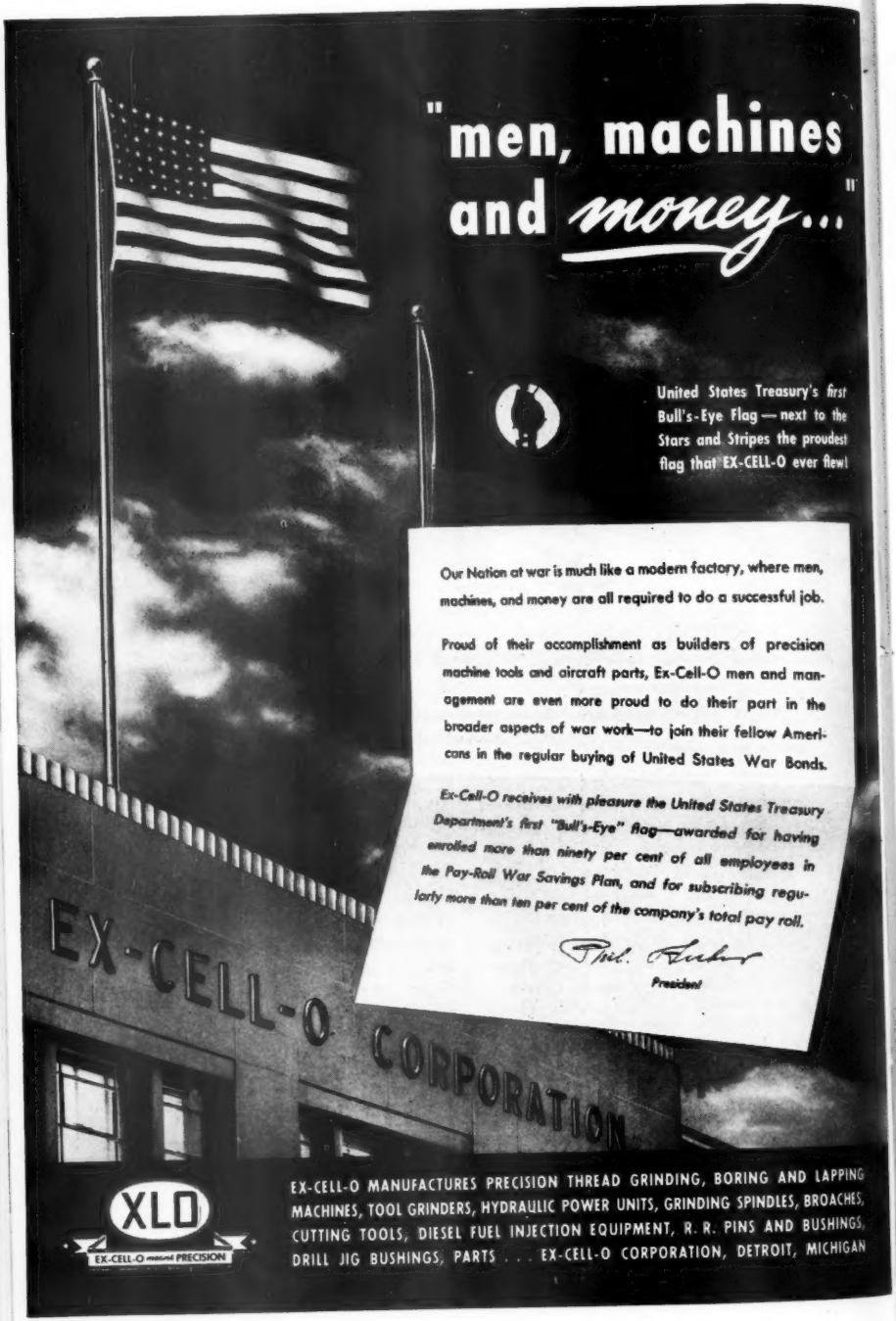
Percentage Of Alloys In Oil-Hardening Tool Steels Competitive To Graph-Mo

Steel	Silicon	Molybdenum	Chromium	Vanadium	Tungsten	Manganese
A		.20				1.60
B				.20	1.25	
C			.50		.50	1.20
D			.70		.50	1.00
E			.50	.20	.50	1.20
F			.50	.25	.45/.75	1.20
G						1.50/1.80
H			.50	.15	.30	1.30
I			.70	.11	.50	1.30
J			1.60		.45	
K			1.20	.20		.90
L			.27	.25		1.70
M			.40	.10		1.30
N			.60		.40	1.20
O			.50		.50	1.05
P			.50		.50	1.15
Q			.50	.25		1.25
R			.50		.50	1.20
S			.20			1.65
T			.50		.50	1.20
Graph-Mo	.75/.85	.25				

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO
Steel and Tube Division

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.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Proud of their accomplishment as builders of precision machine tools and aircraft parts, Ex-Cell-O men and management are even more proud to do their part in the broader aspects of war work—to join their fellow Americans in the regular buying of United States War Bonds.
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XLO
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J			1.60		.45	
K			1.20	.20		.90
L			.27	.25		1.70
M			.40	.10		1.30
N			.60		.40	1.20
O			.50		.50	1.05
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Graph-Mo	.75/.85	.25				

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO
Steel and Tube Division

TIMKEN
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Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

Tooling and Production Executives:

You can't afford to be without this

BIG NEW BOOK *on* ARC WELDING

The "Bible" of the Industry

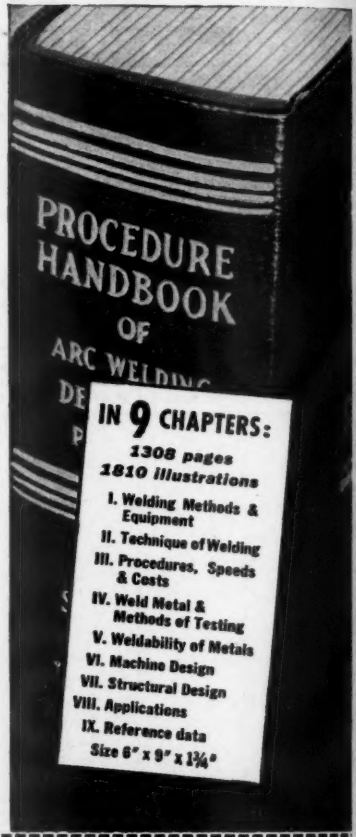

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Illustration of 100-ft. coils

DoAll BAND SAWS

The *continuous* cutting ability of DoAll Contour Saws is a real production feature. Twenty-five thousand separate teeth contact the work *every minute* when a 10-foot DoAll band travels at the rate of 150 f.p.m. The constant chip producing capacity makes this the fastest machining method of slicing off metal ever devised.

IF YOU HAVE A TOUGH MACHINING JOB—

One that has you stumped—send it to our Research Laboratory, the only place of its kind, for free analysis. Our experts will make tests and submit a detailed report showing you how to do the work in the quickest, easiest manner.

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Each 100-ft. coil comes in a strong metal box, through the slot of which any desired saw length can be drawn and cut off.

FREE—*32-page book on DoAll Band Saw Performance.*

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IMPORTANT OCTOBER ISSUE

3 GOOD REASONS

Why the October

TOOL & DIE JOURNAL

will have higher-than-usual reader interest

1 SHOW-IN-PRINT STORY OF NATIONAL METAL CONGRESS

Whether or not you plan to attend America's War Conference on Metals (in Cleveland's Public Auditorium, October 12 to 16), you will want to read all about it in next month's TOOL & DIE Journal. In a special 32-page section we will give you *all* the information about the program and the exhibitors . . . highlighting the year's important developments in machinery, materials and methods. Don't miss it!

2 NEW COVER DESIGN

Keeping pace with your own successful efforts in speeding the Victory Program, the October issue will come to you in a newly designed cover . . . handsome, modern, streamlined.

3 NEW TYPE OF BINDING

For greater durability and service, The TOOL & DIE Journal will hereafter use the so-called "side-stitch" style of binding . . . costlier, better looking, more convenient for filing.

THE TOOL & DIE JOURNAL 2489 FAIRMOUNT BLVD. CLEVELAND, OHIO

OF YOUR FAVORITE MAGAZINE

If You Sell Equipment and Materials to

WAR PRODUCTION PLANTS ARSENALS • TOOL SHOPS

... use the October Issue to tell your story to 20,000 of your best customers and prospects.. the key men who make decisions on what to buy!

THE CREAM OF THE INDUSTRY'S BUYING POWER

These 20,000 key men are the owners, general managers, engineers, superintendents and foremen in 13,000 plants. Their responsibility is a better tool or production job—faster. They are interested in new developments. They have the authority to buy.

OUTPULLS ALL OTHER PUBLICATIONS

That's why The TOOL & DIE Journal gets results out of all proportion to the number of copies issued. Repeatedly it outpulls all other magazines in its field—because it delivers your message to the real buying power in the war production industries.

Write for the full story

PLEASE
send your space reservation early.

SEPT. 30
is closing date for copy if proofs are required.

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is closing date for complete plates.

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FOR DEFENSE PRODUCTION
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DRILL ★ PRESSES
Duro slow speed—high speed—table models—floor models—single spindle—two spindle—four spindle drill presses are available.
Here are presses that have stability. Presses on which you can depend. Presses whose performance is notable.
Careful machining of superior materials, correct balancing, the use of four ball bearing spindle support, rigid construction, careful assembly, detail inspection, assures you long, satisfactory drill press performance.
Get the facts.
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For DURABILITY use DUROBILT★TOOLS

TWO TOOL STEELS CAN CUT AS CHEAPLY AS ONE

WHAT'S more important, two tool steels can cut twice as *fast* as one, and speed is the prime urgency in war production.

But there are ways of increasing production beside installing more modern types of machine tools. A better tool steel, or one better suited to an individual job, can materially speed up the work your existing equipment is capable of doing.

Take the case of a big Detroit plant, using DBL High Speed Tool Bits instead of a high-tungsten variety, machining castings of X-1340 steel with a surface hardness of 33 Rockwell C, and a subsurface hardness of 26-28C. The DBL Tool Bits showed 30% increase in work done between grinds, running at 166 RPM against a previous speed of 100 RPM.

Our Service Staff is ready to help you team up tool steels with your production jobs, for more work done per machine. They'll show you the best *alternate* steels, too, as a precaution in keeping the lines moving.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

HOW TO GET THE MOST OUT OF YOUR LATHES

No. 1 ***in a series of suggestions made by the South Bend Lathe Works in the interest of more efficient war production.***

Keep Your Lathes Clean

Yes, it's as simple as that. Keep your lathes clean and you increase production, reduce scrap, and lengthen the life of your equipment.

This will not only benefit you, but it will also be a definite contribution to our total war effort.

A small paint brush is convenient for brushing away dirt and chips

Dirt Is Abrasive

The scale, grit and fine chips produced by the cutting tool mix with the oil on the bed ways, dovetails and other bearing surfaces, forming a dirty sludge. Because this dirt is abrasive, it increases friction and causes wear wherever it is allowed to collect.

A small paint brush is convenient for brushing away loose dirt and chips. Compressed air is not so good because it may blow dirt and chips into oil holes and bearings. A clean cloth can be used, after brushing, to remove the last traces of dust and grit. A little oil on the cloth will prevent rust from forming on the finished surfaces.

The felt wipers on the ends of the saddle wings should be removed and cleaned in kerosene occasionally. An experienced machine tool service man should periodically inspect the lathe and remove any grit or chips that may have worked under the saddle or tailstock. The bed ways can be badly scored by a small steel chip imbedded in the saddle or tailstock base.

Don't Let Chips Collect

Adequate chip disposal should be provided to prevent chips from piling up underneath or around the lathe.

Now, when most machine tools are operating 24 hours a day, a small amount of carelessness may cause excessive wear — even a breakdown. Certainly an ounce of prevention is now worth far more than a pound of cure.

Write for Bulletin H1

Bulletin H1 giving more detailed information on the cleaning and care of the lathe will be supplied on request. Reprints of all advertisements in this series can also be furnished.

SOUTH BEND LATHE WORKS

Dept. 200 South Bend, Ind., U. S. A. Lathe Builders for 35 Years

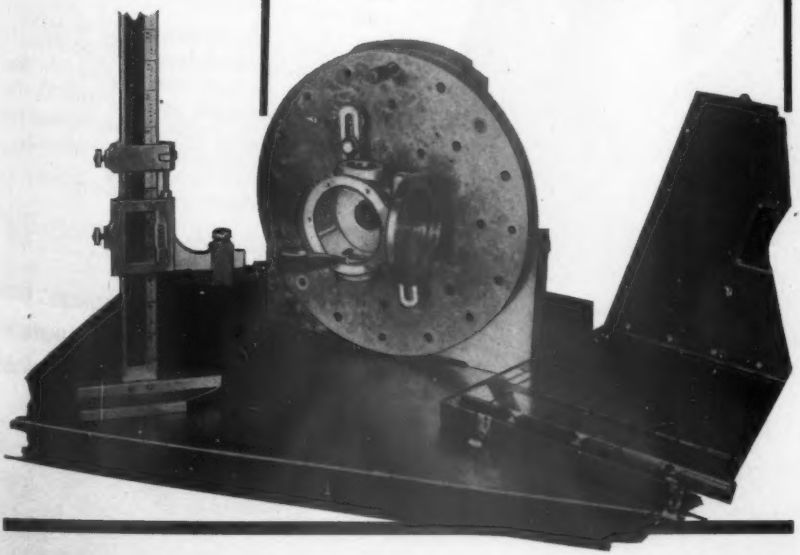
NO GUESSWORK HERE!

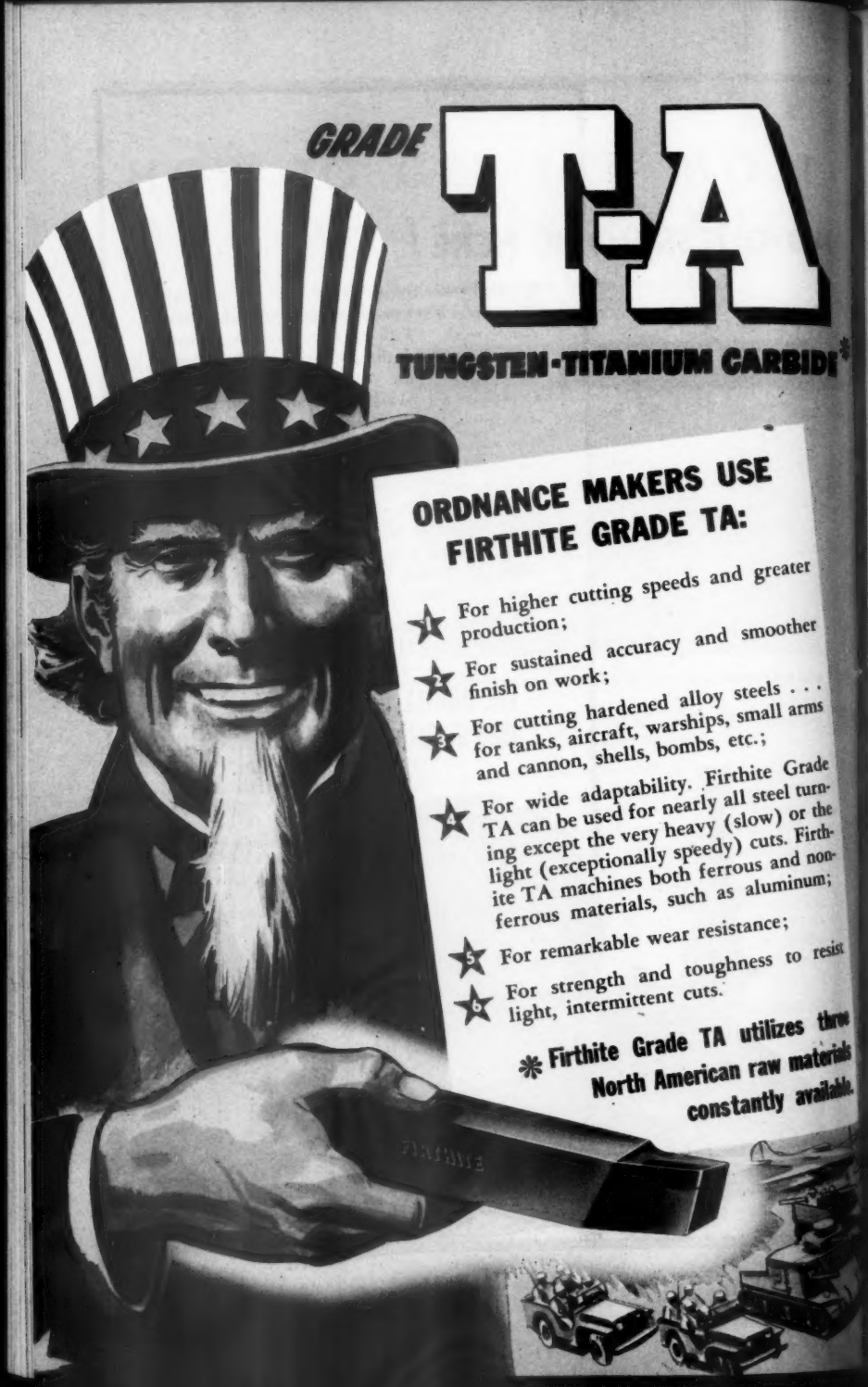
THE Becker Index Master does not make mistakes. It is a precision unit and performs precision work. With aircraft, navy or ordnance parts demanding the greatest possible accuracy to conform with drawing specifications, the Becker Index Master accurately and speedily determines their conformance with drawing specifications. There is no place in the tool room and die shop today for trial and error methods!

Comparing the present methods used in the inspection and layout of tools and parts where a bevel protractor sine bar must be set for each dimension, the great time saving advantages of using the Becker Index Master can readily be seen.

A new descriptive circular on the BECKER INDEX MASTER is available. Address:

THE BUNELL MACHINE & TOOL CO.
1620 E. 24th St. Cleveland, O.




GRADE
T-A
TUNGSTEN-TITANIUM CARBIDE*
ORDNANCE MAKERS USE FIRTHITE GRADE TA:
1 For higher cutting speeds and greater production;
2 For sustained accuracy and smoother finish on work;
3 For cutting hardened alloy steels . . . for tanks, aircraft, warships, small arms and cannon, shells, bombs, etc.;
4 For wide adaptability. Firthite Grade TA can be used for nearly all steel turning except the very heavy (slow) or the light (exceptionally speedy) cuts. Firthite TA machines both ferrous and non-ferrous materials, such as aluminum;
5 For remarkable wear resistance;
6 For strength and toughness to resist light, intermittent cuts.
* Firthite Grade TA utilizes three North American raw materials constantly available.

FIRTHITE

AMERICA'S VICTORY WEAPON ON THE PRODUCTION FRONT

FIRTHITE Grade TA was developed to outperform any other cutting material used for machining steels under "average" conditions.

FIRTHITE Grade TA's sensational, dependable performance is due to the special composition; Tungsten, Cobalt, **and Titanium**—all three obtainable in ample quantities to fill wartime needs.

TITANIUM—the "wonder" ingredient in Firthite Grade TA Sintered Carbide—confers these important advantages:

TITANIUM enables the Firthite TA user to do a better, faster job of steel cutting;

TITANIUM gives the Firthite TA user a tool at a price comparable to that of high-speed steel, plus much greater productivity for the money.

TITANIUM assures the Firthite TA user of a reliable supply, since TITANIUM is one of the commonest metals — no possibility of shortage.

TUNGSTEN—essential in all sintered carbides—is available in large amounts for making all grades of FIRTHITE. (Firth-Sterling Steel Company owns the Wolf Tongue Mining Company —producers of tungsten in the United States.)

* * * * * * *

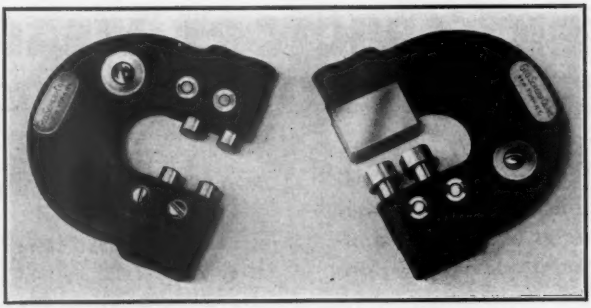
In addition to Grade TA, Firthite is made in many other grades for speedy machining of steel, cast iron, non-ferrous metals, and non-metallic compositions.

TOOL STEELS AND CARBIDES FOR COMPLETE SHOP TOOLING

Firth-Sterling
STEEL COMPANY

OFFICES: McKEESPORT, PA. NEW YORK HARTFORD LOS ANGELES CLEVELAND CHICAGO PHILADELPHIA DAYTON DETROIT

SNAP GAGES



Many plants engaged in war work are using Atlantic Adjustable Limit Snap Gages to quickly and accurately inspect parts urgently required. These gages are manufactured to American Gage Design Standards. Frames are made of Meehanite, a material that will retain its form indefinitely. Thousands of Atlantic Snap Gages are used daily in America's leading plants. When Snap Gages are used little dependence is placed upon the individual's measuring skill. After the gage is set, practically any operator can tell by the go and no-go parts of the snap gage whether the work under inspection has been produced to the correct limits.

Write today for folder showing all types produced.

Scherr Tool Stand

The SCHERR TOOL STAND is used as a vise or clamp for holding micrometers, snap gages and other tools. It eliminates possibility of error due to body heat which can distort micrometers and gages sufficiently to make accurate measurements difficult. The stand speeds up gaging since it frees both hands for checking the work, increasing skill and reducing fatigue. Price Scherr Tool Stand - - $7.50. Write for leaflet.

Illustrated above is Reed 1-2" micrometer, now available in 1/1000" and with vernier to 1/10000". *Write for folder.* Reed Micrometers are also manufactured in 1", 3" and 4" sizes.

GEO. SCHERR CO., INC. 128-B LAFAYETTE ST. NEW YORK, N. Y.

1/44 the thickness of a postage stamp

YOU CAN GRIND THAT ACCURATELY WITH A DUMORE

Write For This Helpful Instruction Book On Precision Grinding

Maintenance of tools is a vital wartime necessity. For this reason, the Dumore Company now offers this practical handbook FREE if requested on your company letterhead. Regularly priced at 25 cents.

This is a war of men and machines—the greatest race in production in the history of civilization. Never before has it been more important to make the most of your manpower and production facilities. Dumore Grinders are doing their part by speeding up war production in arsenals, shipyards and the metal-working industry, modernizing old machines, saving labor, and cutting costs. The No. 5 shown above, with a 3-bearing extension quill, handles a deep internal grinding job on a Heald lathe. Dumore Grinders can be mounted on lathes, shapers and milling machines for internal as well as external grinding. They can hog off rough cuts, yet finish to an accuracy of .0001"...1/44 the thickness of a postage stamp. The Dumore tradition of quality is based upon a quarter century of research in precision grinding and the highest standards in material and craftsmanship. Call on Dumore to help you in your war production problems. See your nearest distributor, or write today.

THE DUMORE COMPANY, 372-J, Racine, Wisconsin

Dumore PRECISION Grinders

There's always something new in
THE WALES LINE
SEPTEMBER 1942
Sun Mon Tue Wed Thu Fri Sat
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MONTH IT'S
EXPANSION
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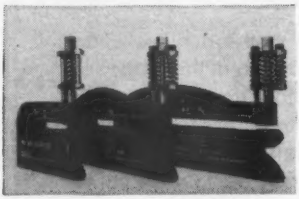
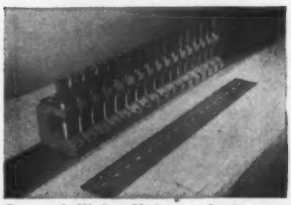
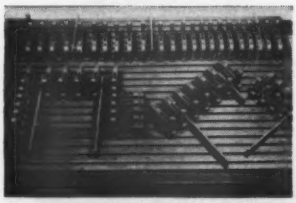
A NEW PLANT • A NEW ADDRESS • • QUICKER DELIVERIES
MORE NEW WALES PRODUCTS



Above shows Wales "Selective Strippers" of 1, 2, and 3 interchangeable springs to provide the exact stripping action required for each job.



Gang of Wales Units on brake press rail.



Showing 3 set-ups of Wales Units on one T-slotted plate.

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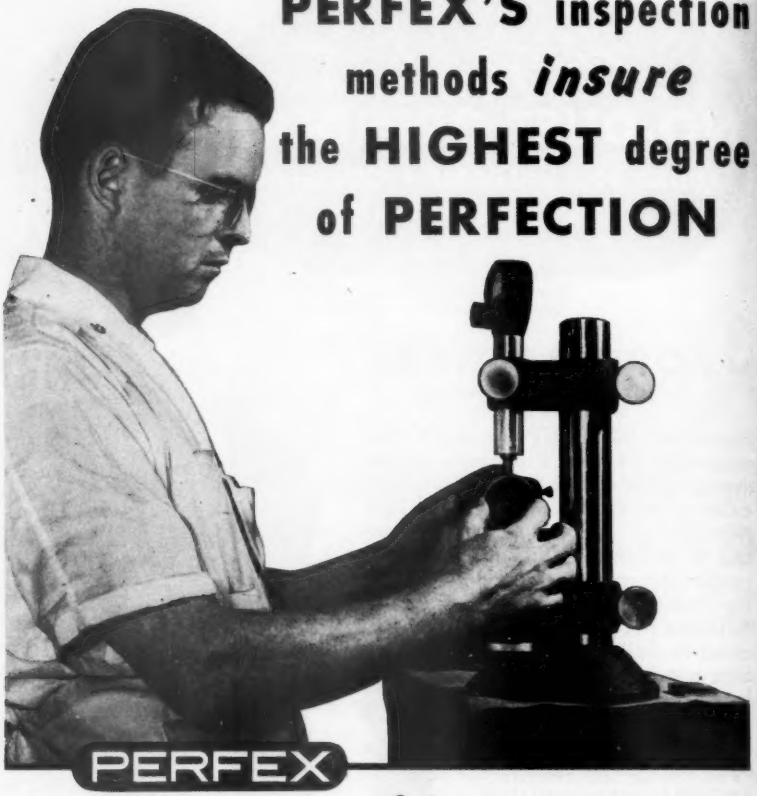

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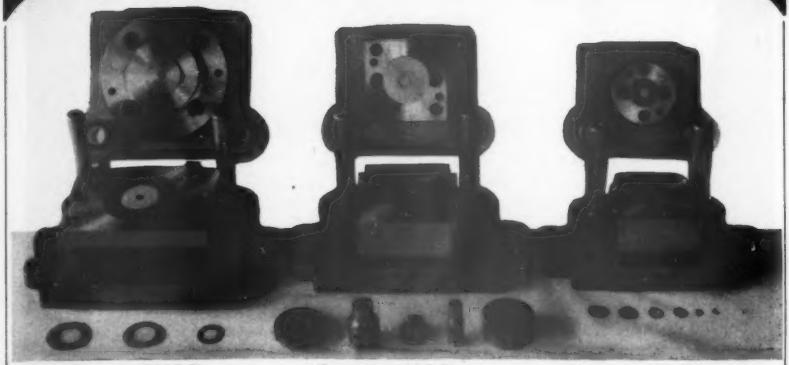

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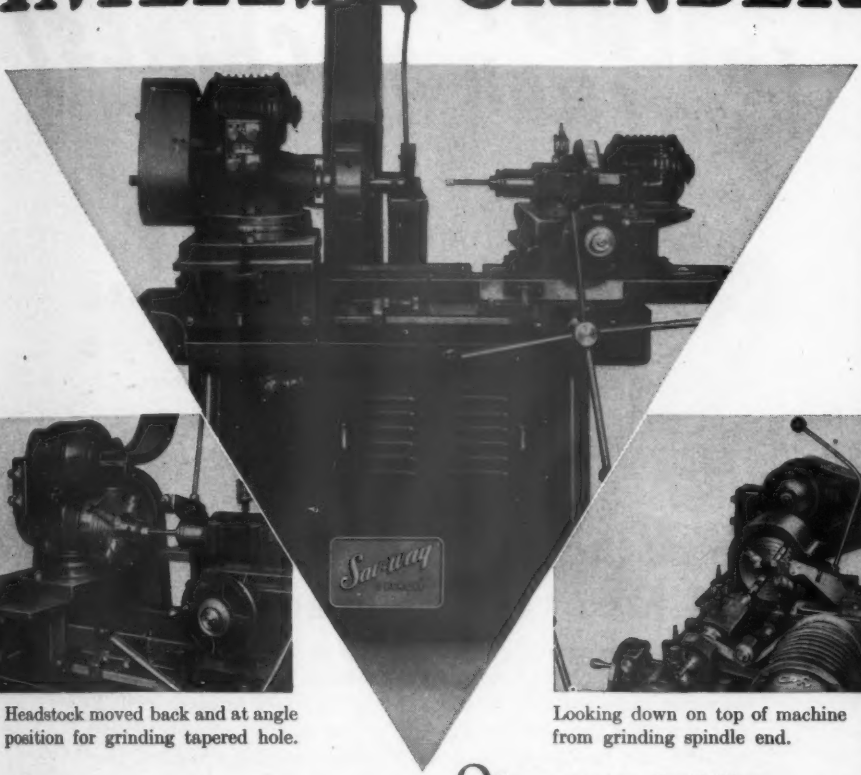

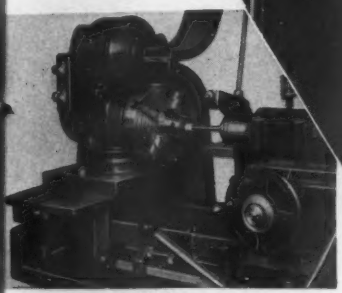

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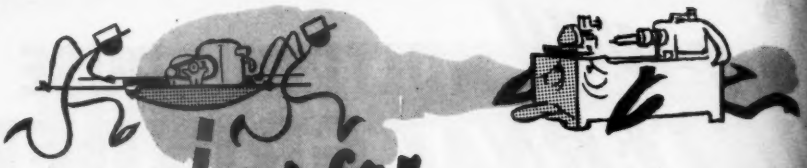

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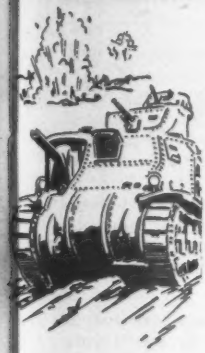
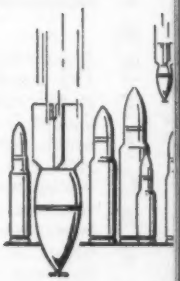
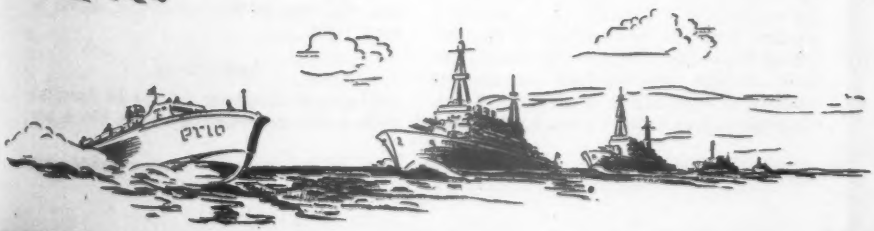
The Plasticator will present new developments in mold design, production and finishing methods, and similar fabrication subjects.







Buffing, Assembling and Painting is covered in this third article of a series on Finishing Methods and Equipment for

Molded Plastics

PLASTICATOR

MOST plastics buffing is done with muslin wheels which are sewed together rather loosely. These wheels are mounted upon double-shaft buffing stands which provide a rotational speed of about 1200 rpm for a 12″ or 14″ wheel. One horsepower per wheel is adequate, but for continuous, severe service 3 to 5 horsepower per double-shaft stand is better. The wheels are loaded with buffing compound by rubbing a stick or brick of the compound upon them as they rotate.

Many types of simple fixtures speed up buffing operations. For round work, spinners are used. The work is placed on the fixture, which has a loose handle. When the piece is held against the wheel the spinner allows the force of the wheel to rotate the piece while the handle is held firmly in the operator's hand. For irregular parting line buffing, the fixtures are not usually required. A number of small parts, however, can be put in a single holder.

Production rates for buffing are among the most difficult to estimate because of the variety of conditions in which a molded part can be received in the finishing department. If for any reason the mold surface becomes dull, the amount of buffing required is increased. Flash conditions may vary considerably because of difference in quality of work done by the edgers, or because of heavy edges caused by poor mold closing. When parting lines are irregular the halves of the moldings may be overshot, requiring a great deal of work in the buffing department. Rates may vary from 50 pieces per hour for large complex pieces to 1000 per hour for fully automatic set-ups in which the operator merely loads and unloads a rotating station type fixture carriage.

Thermosetting materials are not as likely to burn or scuff as are thermoplastics. Care must be exercised for both materials to avoid this difficulty. When the skin is ground off thermosetting molding, a porous wood-flour filler is uncovered which does not take as high a luster as is produced by a polished mold. A satisfactory luster can be obtained by filling these pores with various waxy buffing compounds. Thermoplastics are usually not filled so no porous buffing problems are encountered. There is greater danger of burning, however, because the material softens under heat and the final buffing operation should be very light.

Assembling

The mold designer should be familiar with a few assembly methods which are

used for plastics even though this plant does not do much assembling. Assembly knowledge on the part of the molder and finisher eliminates many difficulties due to improper manufacture. Many times the molding engineer can speed up production and reduce costs if he understands fully what is required of his product for assembly purposes. He can suggest modification of the customer's design to simplify manufacturing methods without detriment to the quality of the moldings supplied.

Speed clips and self-tapping screws are modern high speed assembly devices

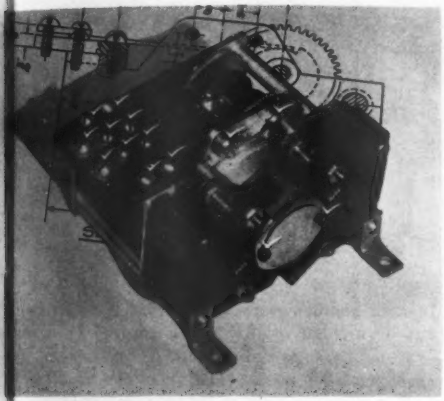


Fig. 1 — An electric timer with check marks indicating the removable type self-tapping screws. Photo, courtesy Parker-Kalon Corp.

which supplant in some instances screw threads and cementing.

There are many standard types of speed clip fastenings available from stock or any practical size and shape can be made. Perhaps speed clips find their greatest application in use with thermoplastics materials which are soft and allow the clips to bite into the plastics moldings. The clips replace regular nuts and are pushed directly over a metallic screw or over a plastics stud which is molded on the piece for assembly purposes. The shape of the locking portion is such that it digs into the molding and a dislodging force tends to make the points dig in deeper. The same type of clip, when used with a screw, hooks under the threads and disassembly can be accomplished by twisting the screw. The range of applications is so great that space limitations prohibit anything more than an elementary description. Specific applications are design problems in themselves.

Three general types of self-tapping screws have been found useful for plastics fastenings. One type is suitable for general use in all kinds of plastics. A second is intended for use with the thermosetting materials which are similar to cast iron in that the chips are powder-like. The third type is well suited for thermoplastics materials in that it is possible to form a sort of rolled thread due to the cold flowing properties of thermoplastics.

The general utility type "U" drive screw for any kind of plastics is intended to be pressed or driven into a cored or drilled hole. This type of screw is recommended only for permanent assemblies because removal is likely to result in the destruction of the tread in the tapped hole. As the screw is forced into the hole, its hardened steep spiral thread forms a thread in the plastics part. The pilot at the tip holds the screw in a vertical position for starting and causes the screw to follow the hole as the driving continues. The diameter of the pilot is larger than the root diameter and smaller than the outside diameter of the screw. The material which is displaced is forced between the threads and the pilot, thus making the screw a force fit in the hole and preventing its backing out. The general utility drive screw is shown at the left in Fig. 2.

For phenolics, ureas and cold molded materials a hardened self-tapping screw known as type "F" works very well. The tap-fluted pilot end makes it possible for the screw to cut its own thread as it is driven into the hole. This screw is especially designed for materials which have a crumbling or granular nature. It can be removed without destroying the thread in the part into which it is tapped, but the plastics materials themselves are not well suited for frequent

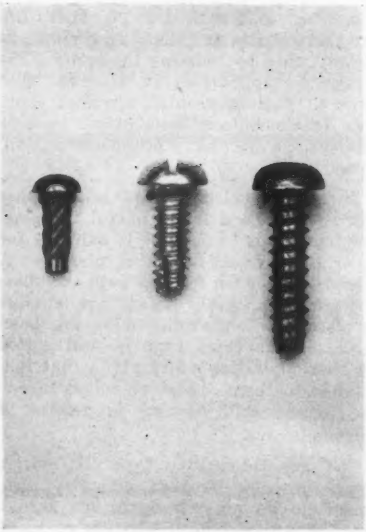


Fig. 2
Left—General utility drive screw
Center—Self-tapping screw for thermoplastics
Right—Drive screw for thermoplastics

assembling and disassembling as they disintegrate and wear out. The self-tapping screw for thermosetting materials is shown in the center of Fig. 2.

A standard hardened self-tapping sheet metal screw, type "Z," is applicable for plastics materials such as thermoplastics acetates, butyrates, acrylates and the thermosetting cast resinoids, all having cold flowing properties. The form of the screw features a narrow thread and wide groove, which in turn forms a wide thread standing up in the tapped hole. The thermoplastics and cast resinoids are relatively soft at room temperature and lend themselves well to cold flowing under the rolling action of this type of self-tapping screw. The hole to be tapped is made of proper size to allow some material to be displaced as the screw is turned in. Thus, a rolled thread is formed on the part to be tapped. The material extruded by the thread on the screw is forced into the groove of the screw and makes a tight fit which will stand up well under numerous assembling and disassembling operations. This is partly because the plastics material does not crumble away and partly because the form of the thread provides a generous plastics thread with a wide land. The drive screw for thermoplastics materials is shown at the right in Fig. 2.

Many stock styles of head and body are available for self-tapping screws. Manufacturers' catalogs should be consulted for specific designs and their application data followed for best results.

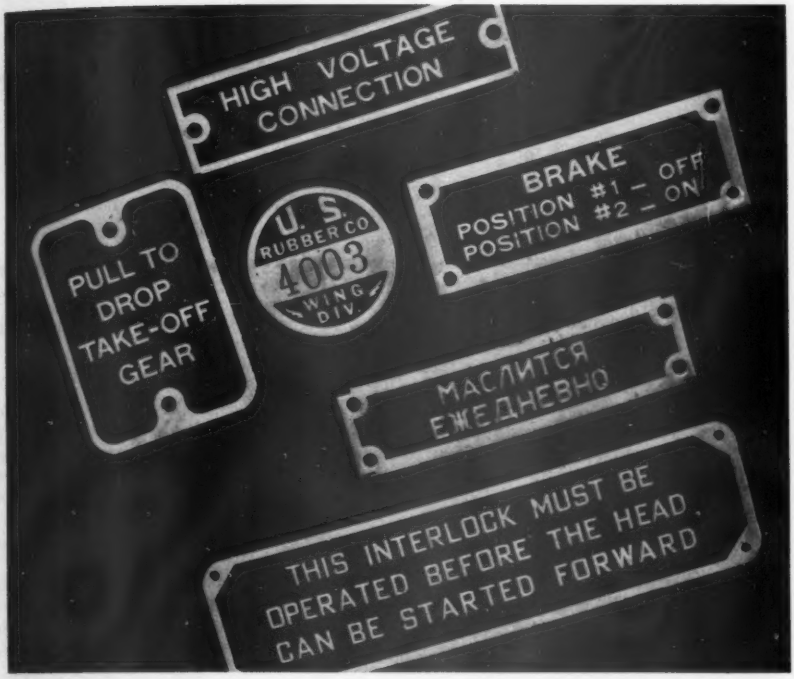
The use of American Standard screw thread fastenings in plastics is probably more extensive than all of the other methods of fastening combined. Certain principles apply for plastics and they are outlined here.

When screw fastenings are made directly into the plastics material the assembly should be of a more or less permanent nature. Plastics threads are not well adapted for the severe wear induced by frequent assembling and disassembling. Threaded metal inserts are better from the standpoint of wear resistance. Only a complete analysis of a particular application can show if metal inserts are less expensive than threads cut or molded in the piece.

Fine threads have shown, in some cases, to have better holding power than coarse threads. When threads less than .030" to .040" deep are used, it is well to make sure there is enough material behind the threads to provide rigidity. If there is insufficient rigidity in a nut, for example, the nut may expand slightly when tightened; the threads will climb up on one another and may be easily stripped.

Assembly fixtures for screw fastenings are usually simple. They are devised to hold the work in position so the assembler may have both hands free to put in the screws. Power drivers are used for speed and to adjust torque to the proper value. The use of a power driver with an adjustable torque chuck helps prevent stripping threads and assures an assembly which is exactly tight enough—a factor of extreme importance in aircraft assemblies. A rachet screw driver is a simple tool for assembling

(Continued on Page 119)



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Saran pipe is produced in smooth, round, accurately sized lengths having dimensions identical with those of strong iron pipe. It can be readily welded, heated and bent. The illustrations show a welding operation which takes less than one minute. The pieces are placed on a hot plate heated to 350°-400° F and held until molten material appears. The pieces are then placed together in proper position—pressed firmly and allowed to cool for 10 seconds. The resultant weld has greater joint strength than the pipe itself.

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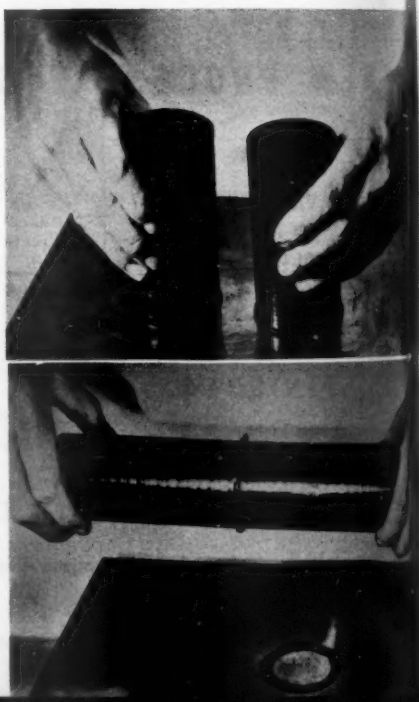
In demonstrating the threading of the larger plastic pipe sizes, Dow engineers advise inserting a close fitting plug within the end to be threaded to guard against compression of the pipe and resultant shallow threads. This precaution is not absolutely essential providing sharp dies are used.

Weight of this pipe is naturally much less than comparable sizes of iron pipe. This, too, is a decided advantage in shipping, general handling and suspension.



PLASTICS MOLD DESIGNING —

by Gordon B. Thayer

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The third article in the authoritative series, "Finishing Methods and Equipment for Molded Plastics," covers Buffing, Assembling and Painting operations. *Turn to page 86 of the Plasticator section.*

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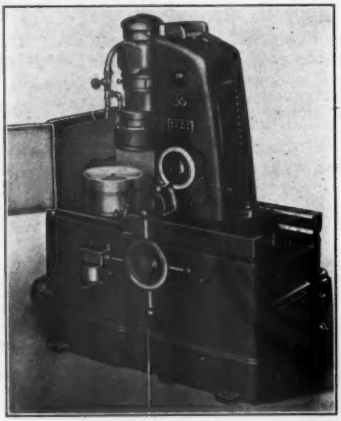

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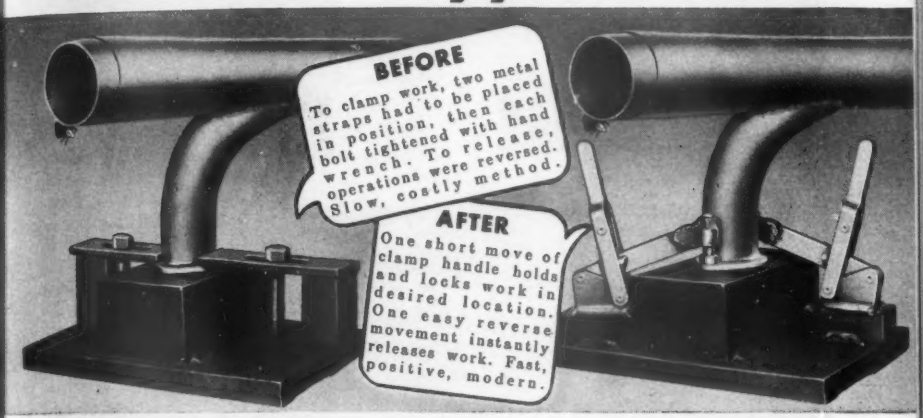
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AFTER
One short move of clamp handle holds and locks work in desired location. One easy reverse movement instantly releases work. Fast, positive, modern.

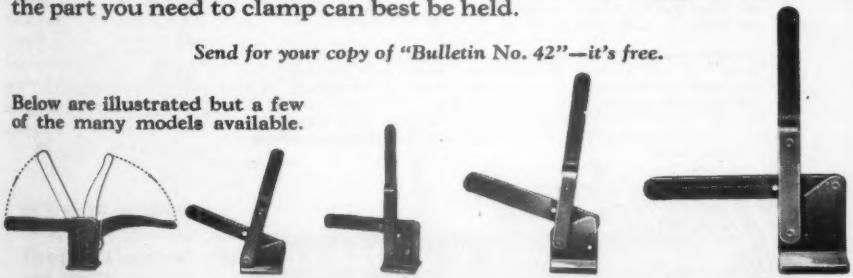
This fixture built only for checking flatness of flange and parallelism of tube, yet since 100% inspection was required a low cost fixture was needed, and De-Sta-Co Toggle Clamps again filled the bill.

The advantage of using De-Sta-Co Clamps lies in your ability to build a simple or more complicated fixture for purposes of increasing production, for less cost and in shorter time. Also by use of a confining nest for piloting, the clamp will not close unless the part is in proper location, which prevents errors due to stray or interfering chips.

De-Sta-Co Toggle Clamps Bulletin No. 42, just off the press, illustrates many different types of fixtures, some of which may suggest to you how the part you need to clamp can best be held.

Send for your copy of "Bulletin No. 42"—it's free.

Below are illustrated but a few of the many models available.



No. 215
Horizontal Style
Light Duty

No. 220
Light Weight
Popular Model

No. 210
Straight Bar
Medium Heavy

No. 250
Heavy Duty

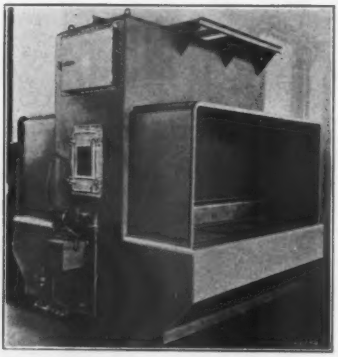
No. 110-CO
Heavy Duty
Low, Straight Bar

★ ★ ★ ★ **DETROIT STAMPING CO.** ★ ★ ★

Established Over 25 Years

344 Midland Ave • Detroit, Mich.

Hydro-Foam Dust Collector Has Entirely Pneumatic System



AN exceptionally simple and economical means of dust collection and removal is offered to the industry in the Hydro-Foam Dust Collector. An entirely pneumatic system that dispenses with spray nozzles, pumps and cloth screens is provided. Thus, there is nothing to clog, get out of order or be subjected to excessive wear.

After collection, the dust-laden air is drawn into the Unit where the heavier dust particles drop by gravity into the sludge tank located in the base, completing the first stage of dust elimination.

Still carrying a considerable volume of dust, the air is then carried into a battery of accelerators, which direct the air downward at high velocity against the solution in the sludge tank. This second stage of dust elimination forces the bulk of the remaining dust into the solution.

The impinging action of the accelerators agitates the solution in the sludge tank and creates a bed of foam. Through this foam bed pass the air currents which now contain only the most minute particles of dust. The foam serves to retard or smother this finer dust which settles with that previously removed to the bottom of the sludge tank. Thus, the dust is trapped under water as the dust-laden air travels through the Unit and emerges from the exhaust stacks thoroughly cleaned.

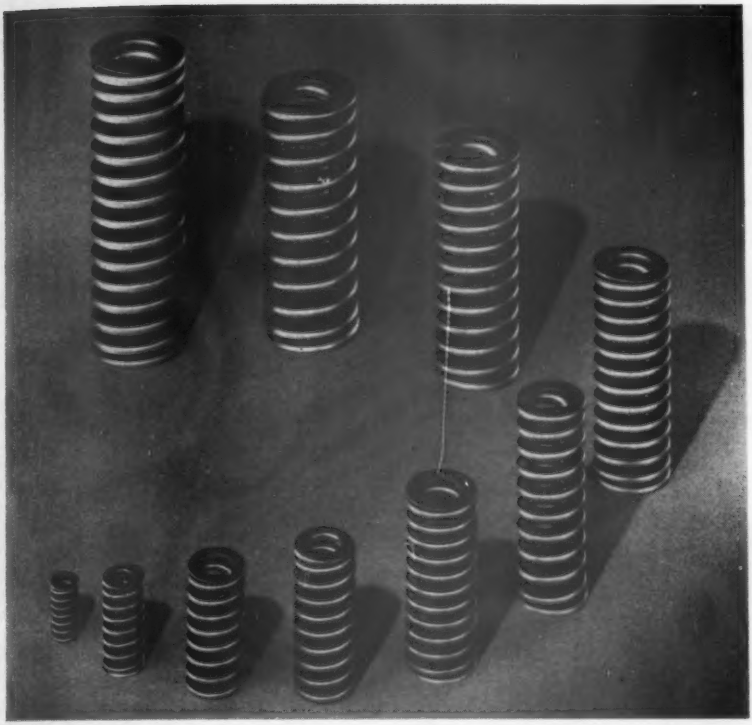
Bulletin DC will be sent by The R. C. Mahon Company, 8701 Mt. Elliott Ave., Detroit, Mich.

Will do 67% of all Straight Dressing Jobs

67% of all straight wheel dressing jobs can be done efficiently with an American "A-20" Cluster Tool. Made of 20 carefully selected diamonds, arranged in four layers of five stones each, set in a special, low temperature matrix, with each stone so spaced that there will always be several sharp cutting points in contact with the wheel during dressing operations. Stones are all permanently mounted, no re-setting required.

Compare our price with what you have been paying for "Cluster Tools" . . . we promise performance beyond your expectations. Improved production facilities, new methods of setting and volume sales permit us to price the American "A-20" at $15.00 F.O.B. Detroit. Price includes any standard type mounting . . . specify your choice when ordering. Price subject to change without notice.

American
DIAMOND TOOL & GAUGE CO.
15924 WOODINGHAM • DETROIT, MICH.



DIE SPRINGS IN STOCK FOR ALL PRESSES • • •

Muehlhausen Die Springs are available in three types—Series "S" for high speed presses; Series "M" for regular speed presses; and Series "HD" for heavy duty presses. Over 200 sizes are stocked, ranging from 1 to 15 inches in length and exerting pressures from 80 to 3000 lbs. Each size and type is specially designed to meet the rigorous demands of die work. Muehlhausen's complete stock assures you of immediate delivery.

FREE! WRITE FOR YOUR COPIES

New Muehlhausen Die Spring Folder describes and prices 206 sizes of die springs for high speed, regular and heavy duty presses.

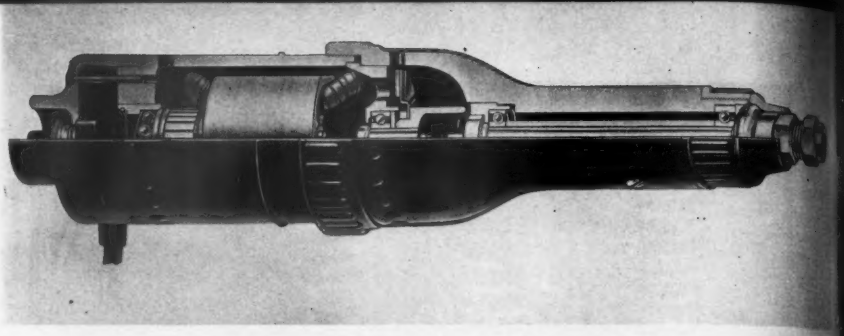
Muehlhausen Spring Corporation
875 Michigan Ave., Logansport, Ind.

Name_____

Address_____

City_____

MUEHLHAUSEN SPRINGS
EVERY TYPE AND SIZE



New Precise Universal Die and Production Grinder

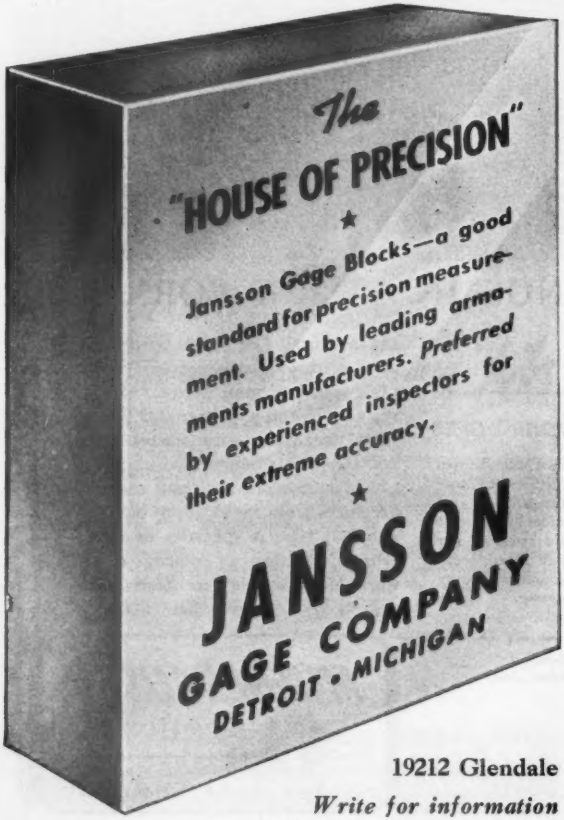
WITH its Precise universal motor, developing approximately 1/7 hp at speeds from 35,000 to 20,000 rpm under load, the Precise 35, it is claimed, does smoother, faster work and preserves grinding and cutting tools much longer than machines of slower speeds.

Convenient and versatile, it always runs cool, operating hour after hour under continuous load. It's practically unbreakable plastic case is insulated completely, eliminating, without the necessity of a ground wire, any danger of shock from current leakage. It is dust, grit and moisture-proof for long, trouble-free life.

Powerful enough for heavy production work, it is capable of fast, fine precision grinding, cutting, polishing and engraving. With its slender spindle head, it is suited for the most exacting internal work in openings as small as $1\frac{13}{32}$" in diameter, to a depth of 6".

With its simple three-piece construction it can be taken apart and reassembled in an instant—has no screws to loosen or fall out. Motor shaft and high precision spindle, with high speed chuck, revolve on 4 precision machined ball bearings. They are joined with the Precise self-aligning insulating elastic coupling, eliminating

(Cont'd on page 136)


The
"HOUSE OF PRECISION"
★
Jansson Gage Blocks—a good standard for precision measurement. Used by leading armaments manufacturers. Preferred by experienced inspectors for their extreme accuracy.
★
JANSSON
GAGE COMPANY
DETROIT • MICHIGAN

19212 Glendale

Write for information

HOW GORTON saves time ON PROFILE MILLING WITH SEMI-SKILLED OPERATOR

GORTON

9-J Super-Speed Vertical Mill with Duplicator Table and Tracer Profiles Crankshaft Part in 15 Minutes Floor-to-Floor Time

● This prominent airplane engine manufacturer (name on request) utilizes semi-skilled help for operating Gorton Super-Speed Milling Machines and Duplicators. The operation being performed is *Profile Milling of a .738" Radius on the Rear Section of a Steel Crankshaft.* Feed is by hand, spindle speed is 500 r.p.m. using a special .738" diameter four-fluted ball cutter. (This cutter is ground on a Gorton 375-2 Cutter Grinder.)

This is an excellent example of the ease of operation of Gorton High-Speed Millers and Duplicators in performing unusual operations.

AN EASTERN MANUFACTURER OF TOOLS AND DIES WRITES: "...MOST IMPORTANT TODAY IS THE FACT THAT WE CAN USE WOMEN TO OPERATE THESE MACHINES."

SUPER-SPEED MILLING DATA

OPERATION—Profile Mill .738" Radius.

MACHINE—Gorton 9-J Super-Speed Vertical Mill with Duplicator Table and Tracer.

PART—Rear of Crankshaft—Steel.

CUTTERS—Special .738" dia. Ball Cutter—Profile Form Type—4 Flute.

HOLDING—Special Fixture.

FEED—Hand.

SPINDLE SPEED—500 r.p.m.

STOCK REMOVED—⅛".

FLOOR-TO-FLOOR TIME—15 Minutes.

FREE

Additional data and specifications are included in this booklet. Write for your copy today. Ask for Catalog No. 1400-B.

These are but two of many ways in which Gorton Super-Speed Milling Machines are saving vital man hours on form milling.

Perhaps you, too, can save additional hours on your present or new milling equipment. Gorton Engineers, specialists in Vertical High-Speed Milling, will be glad to make recommendations on your work—without obligation.

GEORGE GORTON MACHINE CO.

1319 RACINE STREET, RACINE, WISCONSIN, U.S.A.

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

DoAll Contour Saw Laboratory Expands

FOREMOST in customer service departments, the DoAll Laboratory has long been called upon to solve the cutting problems of narrow blade saw users throughout the country. Now, more than ever before, buyers need the data assembled by these technicians. The manufacturers of DoAll Precision Saw Bands announce the further expansion of their Contour Saw Laboratory and the housing of this department in a building separate from the main plant.

Superbly equipped—complete from photomicrograph and Rockwell testing equipment to a special darkroom—the laboratory solves cutting problems presented either by mail or through territorial representatives. This service is without charge.

At the conclusion of each test, when the question has been answered and a plan for production sawing worked out, a detailed report is sent to the customer. To this is attached a photograph of the actual cutting; also drawings showing the progressive cuts and recommendations for jigs or other fixtures.

A recent test called for designing a self-centering jig for notching precision machine parts within close tolerances without a layout line.

Your problem is welcome at the Contour Saw Laboratory of the DoAll Co., 1203 Thacker St., Des Plaines, Ill.

-75°F

TO KILL GROWTH OF PRECISION GAUGES

TO INSURE ACCURATE CALIBRATION OF AVIATION EQUIPMENT

TO IMPROVE CHILL SHRINK FITS

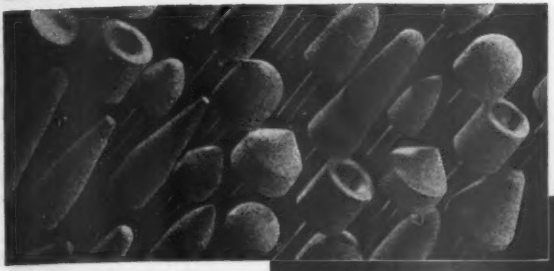
THE NEW REVCO INDUSTRIAL *CHILL CHEST*

In this compact and sturdy Chill Chest Revco offers new accuracy and precision in testing and calibration of aviation materials. Revco engineers specialize in custom-built industrial refrigeration equipment.

Write today for further information.

REVCO, INC., Adrian, Michigan

POLISH 'EM OFF WITH



They're TOUGH *and* DO Their STUFF!

Commandos of the grinding wheel industry —the first small wheels mounted on steel shanks and leading the way today with smoother, more rapid grinding, polishing and finishing of difficult jobs.

Chicago Mounted Wheels—the result of 45 years of KNOW HOW—come in a wide range of styles on different size shanks, for use with any portable or flexible shaft grinder. Several special-formula abrasives give 150% to 300% longer service. More than 200 shapes, all mounted and rarin' to go.

HI-POWER GRINDER

Here's a real production tool—a 3-pounder with enough power to drive a 2½" diameter wheel. 17,000 r. p. m. In case with accessories, $38.50.

LATEST CATALOG—Packed full of comprehensive information and pictures. You'll be interested. Send for copy.

TEST WHEEL FREE

If you have a grinding problem, send for a Survey blank, which you'll find easy to fill out. Upon its return, our abrasive engineers will analyze it and send you without charge the trial wheel they recommend for your particular job.

TD-9

☐ Send Hi-Power ☐ Catalog
☐ Free Wheel. Size _____

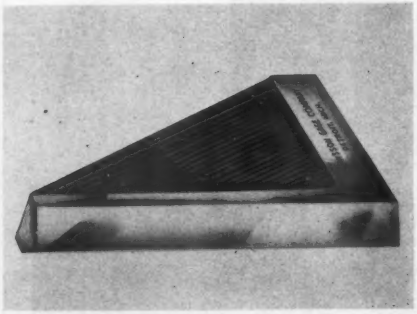
Name _____

Address _____

CHICAGO WHEEL & MFG. CO.

Makers of Quality Products Since 1896
1101 W. Monroe St., Dept. TD, Chicago, Ill.

Jansson Master Tri-Square for Inspection Departments

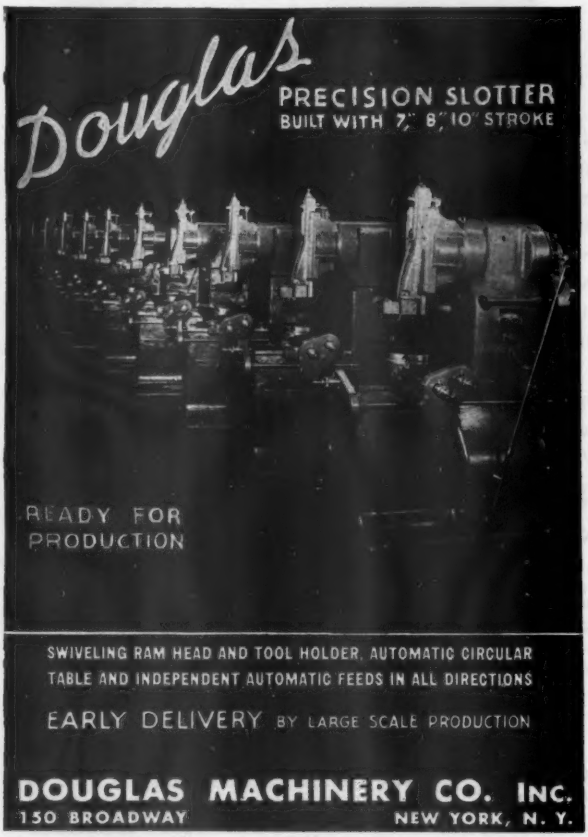


JANSSON Gage Company has produced a Master Tri-Square which is held to limits hitherto unattained. It is suited to extreme precision measurement wherever 90° angles are involved. Held to limits of .00002" base and side, the Master Tri-Square is available in two sizes: 4" in height with a ⅝" wide standing base and 6" with a 1" wide base.

Of one-piece solid construction, the Tri-Square is hardened, ground and lapped from alloy tool steel. Final manufacturing operations are done in a special temperature control room to assure maximum gaging accuracy. An inset hard fibre serrated grip to prevent heat transference and slipping in handling which might cause damage to the Tri-Square is provided. The vertical side edge is knife-sharp for truer visual gaging.

The Master Tri-Square is a basic gage for inspection departments, rounding out any set of inspection tools. It is used in laying out and checking right angle work and square surfaces; and the checking of V's, straight flat edges; and parallelism of cylindrical surfaces.

Further information is available from Jansson Gage Co., 19205 Glendale, Detroit, Mich.


Douglas
PRECISION SLOTTER
BUILT WITH 7" 8" 10" STROKE
READY FOR PRODUCTION
SWIVELING RAM HEAD AND TOOL HOLDER, AUTOMATIC CIRCULAR TABLE AND INDEPENDENT AUTOMATIC FEEDS IN ALL DIRECTIONS
EARLY DELIVERY BY LARGE SCALE PRODUCTION
DOUGLAS MACHINERY CO. INC.
150 BROADWAY
NEW YORK, N. Y.

Reprints

"Typical Designs for Drilling Jigs & Fixtures", a series in six parts by C. W. Hinman, has been reprinted by popular demand. Price 25c per copy.

No matter how tough your schedules are to meet—LIMA GEARSHIFT DRIVES will help you do the job. Whether its turning, milling, boring, planing, punching, shaping, gear hobbing, etc., Lima Gearshift Drives have been engineered to do the work with *Speed* and *Accuracy*. Built in sizes from 1 to 25 H. P., either direct motor or belt driven. Speeds up to 8 forward and 8 reverse. Standard mounting brackets available for most standard machines.

LIMA'S many important features have all been designed to meet specific requirements in the unit motorization of production equipment and to maintain *Speed* with *Safety*. Unsolicited letters of recommendation show that Lima Gearshift Drives are stepping up production from 20% on some types of work to 200% and over on other types. Why not investigate immediately the possibility of stepping up your production with Lima Gearshift Drives. Consult our engineers—their experience is yours for the asking in this common cause. BEAT PRODUCTION SCHEDULES with LIMA GEARSHIFT DRIVES.

REMEMBER! Increased Operator Efficiency means Increased Production so vitally necessary today.

Write or wire us today . . . . Prompt attention to inquiries . . . Prompt Deliveries on Orders.

SEND TODAY FOR FREE DESCRIPTIVE, ILLUSTRATED BULLETINS AND DATA SHEETS.

New Stress Relief Furnace Has Automatic Heat Control

A NEW type car-bottom stress relief furnace, designed by Despatch Oven Co. to remove stresses in weldments and installed in a large midwest farm implement plant, has completely automatic heat control. This permits the operator to follow any predetermined cycle of heat treatment simply and quickly by setting the dials.

Weldments are loaded on rugged, heavy duty, insulated cars which enter the furnace through either of the two lift doors at opposite ends of the heat chamber. Car-bottoms, usually operated by winches, are carefully levelled when installed. This permits correct balancing of loads and minimizes danger of distortion which might result from off-level car platforms.

Effective sealing of the work chamber to promote even interior heating is provided. Electrically operated doors at each end of the furnace slide down smooth channels to form sand-seals at both ends of the car. As these doors descend to the bottom of the channel-grooves, they are forced snugly against properly designed steel members.

The secret of close temperature control lies in the balancing of the heater, fans and circulating ducts on each installation. The heater is of heavy capacity, and is connected

(Cont'd on next page)

TWO MACHINES IN ONE!

For Die-Filing Use Top Table in Position Shown.

For Punch or Blind-Hole Filing Tilt Top Table Back, Use Lower Table.

DIE TABLE Filing From Below

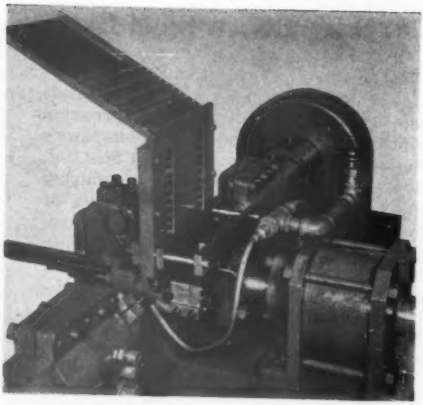
PUNCH TABLE Filing From Above

No more hand filing of intricate jobs or inaccessible parts! With this universal machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1½". Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

Write for Descriptive Circular.

MARBURG BROTHERS, INC.
Exclusive Distributors
90 West Street New York, N. Y.

Automatic Feed on Profiler Increases Production



THE addition of an automatic chute feed to the air chuck on their two-spindle profiling machine has been announced by Pines Engineering Co., Inc. This attachment is being used for feeding such items as brass and copper primer tubes for boring and tapping operations on both ends at the same time.

According to the manufacturer, production from these machines has been increased as much as thirty percent by the addition of this automatic feed.

The Pines Profiler is employed in defense production for burring, chamfering, facing, threading, centering, reaming and boring both ends of tubes or rods simultaneously for such important war items as bombs, tank tread tubes and pins, etc. Several of these profiling operations may be combined and performed at the same time, thus greatly increasing productive output and decreasing man hours.

A completely illustrated 4-page bulletin, fully descriptive of the Pines Profiler and automatic feed, is available. Address Pines Engineering Co., 603 Block Prairie, Aurora, Ill.

---

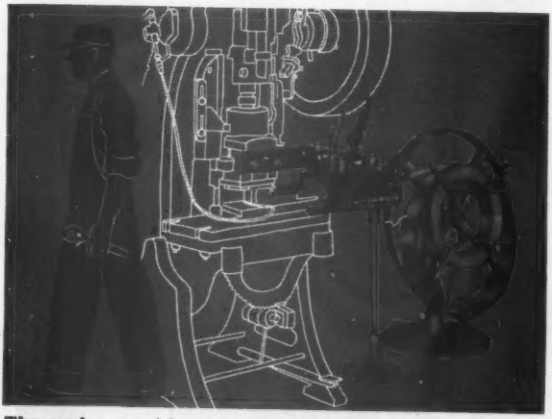
with specially designed high volume fan of alloy steel. Each fan is delicately balanced and has a patented shaft-cooler to insure hard, continuous operation without attention or repair.

Further details are obtainable from Despatch Oven Co., 600 Ninth St., SE, Minneapolis, Minn.

WAR PRODUCTION *rolls out faster with*

WITTEK *Automatic*

ROLL FEEDS AND REEL STANDS



The major problem confronting industry today is increased war production. Manufacturers of metal stampings must recognize automatic feeding of coiled strip stock to punch presses as vital to the solution of their problem.

Wittek Automatic Roll Feeds and Reel Stands are designed and built by engineers with years of experience to guide them. With Wittek you can conserve man-hours and maintain new high production schedules.

★ *Write for Descriptive Catalog*

WITTEK MANUFACTURING CO., 4305 W. 24th Pl., Chicago, Ill.

Bissett Steel Expands; Increases Stock

THE Bissett Steel Company, nationally known steel specialty distributor, has announced an expansion program which greatly increases the company's scope in the general warehouse field. A pioneer in the steel warehouse industry and in the distribution of new types of steel, the company opened its first warehouse in 1920. During the ensuing years, an international business in steel specialties was established. Today, the firm is primarily a general warehouse, though specialties in a limited range are still carried.

In 1925 the present warehouse was purchased from the Paterson-Leitch Co. and, since that time, has expanded steadily. A year ago the company doubled its warehouse capacity and the additional expansion now contemplated will bring the total added space up to 18,000 square feet, with complete new steel handling facilities.

Coincident with the announcement of the warehouse expansion, George Bissett, president, announced that the firm is stocking a range of National Emergency alloys to replace many standard S.A.E. analyses. A series of experiments is now being conducted on NE analyses with machine tool and airplane parts manufacturers.

The company has the exclusive distribution privilege in its territory for several steel producing companies. Thus, it is adequately supplied by these firms during the present shortage. Its connection with other mills enables it to keep certain essential steels, such as cold drawn bars, tool steels and tool steel tubing, in permanent stock for individual customers regardless of quantity.

The Bissett Steel Company carries a complete stock of alloy steels, aircraft steels, tool steels, boiler tubes, ground shafting, tool steel tubing, welding and drill rod, with a heavy current stock of tool steels and alloy steels in hot rolled and cold drawn grades with hexagons, rounds and squares ranging up to 12" x 12". Most of these steels are ready for immediate delivery.

Eliminates Some Costly Tools

Case History No. 4

The adapters are clamped on a "V" block which in turn is mounted on a rotating table on a milling machine. A slotting tool, ground to the exact dimension specified, is fastened to the clapper box tool holder . . . Each spline is cut in a few minutes — after rotating to a new position — the operation is repeated until all of the splines are cut accurately, dimensioned and equally spaced . . . Broaching — the only alternative — would have involved the expense of a series of broaches and broaching operations because the splines stop at the shoulder of the adapter . . . Use of the SLOTMASTER required no tooling expense and only one set-up.

Thumbnail illustrates set-up.

SLOTMASTER can be used on milling machines and provides double duty facilities at a minimum cost. It requires but little time to change-over from one head to the other . . . The stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 r. p. m. . . . The tool holder, of the clapper box type, can be turned in any position . . . All of the working parts are of tool steel heat treated and ground to close tolerances . . . SLOTMASTER comes complete with pulleys, motor, belt and mounting adaptable to round over-arm or flat-on-round over-arm milling machines.

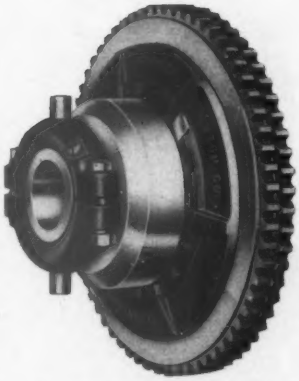
Send for 4-page catalog and give the specifications of the milling machines that you wish to equip. Immediate deliveries on high priorities.

EXPERIMENTAL TOOL & DIE CO.

12609 GREINER DETROIT, MICH.

Conventional set-up on round over-arm milling machine.

Drag-Free Idling Featured in Conway Clutches



THE sturdy construction of Conway Clutches was designed for extreme stresses. The carrier is rugged. The one piece levers or actuators pivot into the rigid carrier—departing from the usual practice of attaching the fragile actuators to floating rings.

Complete enclosure delivers safety, neatness and balance. All parts are designed and machined within the contour of the whole clutch. The adjusting ring of the Conway will illustrate this best. This part, one that needs to be handy at all times, is independent in action from all other clutch members. Yet it is so patterned and placed that its very shape and location serve as part of the enclosure of the clutch mechanism.

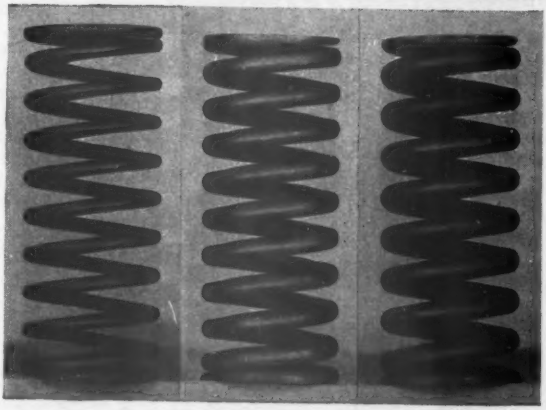
The 40-G Tandem Plate Clutch Mechanism, illustrated, is used when necessary to bring more power into a restricted swing and length. It has twice the power factor in the same diameter as the single plate clutch and takes up but slightly more shaft length.

This Tandem Plate Clutch is particularly suited for hoists, dredges, conveyors and punch presses, where starting and stopping is frequent, where pick-up must be gradual, or where the load must be "teased".

Each size clutch has levers especially designed for its specific range of power and service. Each set of plates is separated by independent springs, insuring drag-free idling, an exclusive Conway feature.

For descriptive literature giving full details address The Conway Clutch Co., P.O. Station B, Cincinnati, O.

We deliver the goods!



DIE SPRINGS IN STOCK FOR PROMPT SHIPMENT

● **Yes, sir . . . three lines of Die Springs *carried in stock* for your convenience! Medium pressure, 50% deflection—medium-heavy pressure, 37% deflection—high pressure, 30% deflection. Precision made for longer life and trouble-free operation.**

WRITE FOR illustrated Catalog giving details on Springs and other Die Maker's supplies.

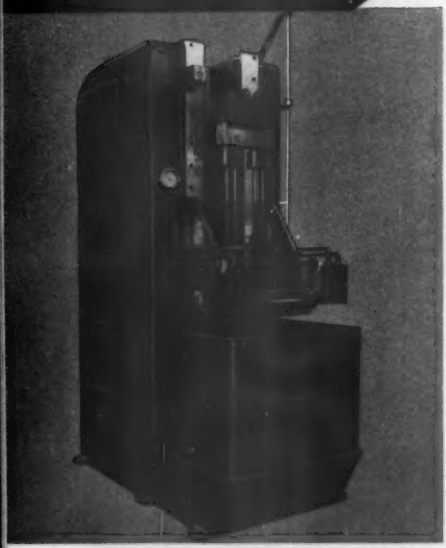
DIE SUPPLY CO.

J. R. Fitzsimmons W. H. Fitzsimmons Jos. T. Fitzsimmons

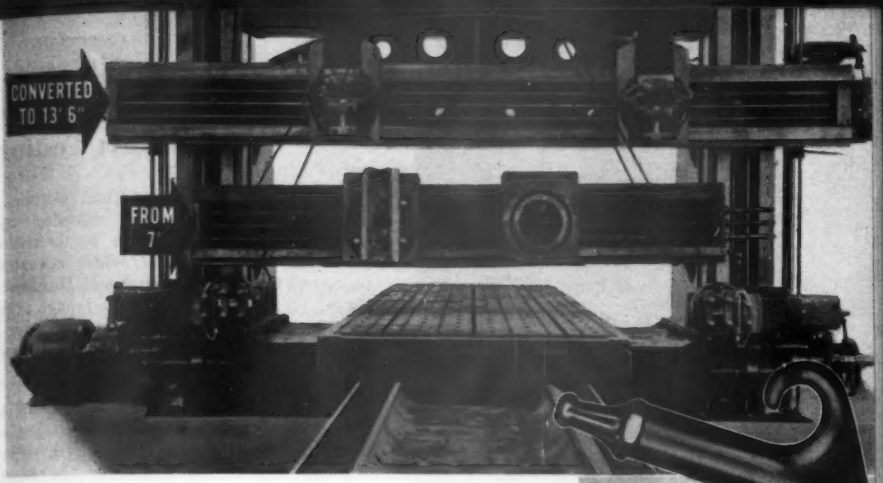
4751 Hough Ave., CLEVELAND, O., EXpress 1133

Progress on Parade

DESIGNED to meet the most rigid government specifications, the LeBlond No. 3 screw feed gun boring lathe has an ease of operation and remarkable flexibility of adjustment that makes it readily adaptable to many gun manufacturing operations. It is equipped with large bore spindles in which the gun is chucked through the spindle so that the drive, when machining, is on the large diameter of the barrel. This method allows the removal of the reaming bits from the end of the bar after it has passed through the bore, eliminating the possibility of damage to the finished bore and reamer. The R. K. LeBlond Machine Tool Co., Cincinnati, O., will send Bulletin 9L, "LeBlond Gun Manufacturing Machines," at your request.



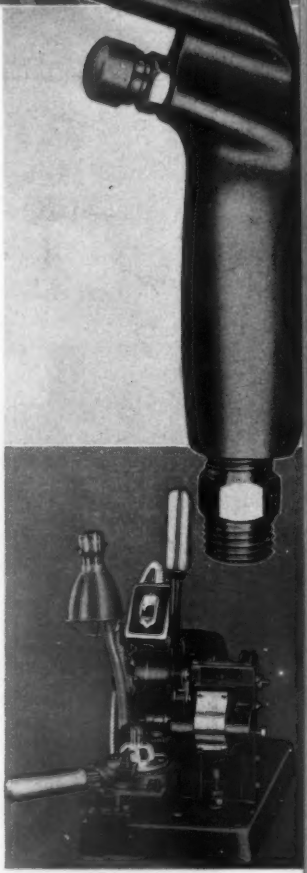
IN DEVELOPING the VP 4-25 ton, 36" stroke vertical broaching machine, the American Broach & Machine Co., Ann Arbor, Mich., have used the proven principles gained from years of actual experience and have added valuable new features. Rigidity and smooth, positive cutting action provide longer broaching tool life and finer hole finishes to the work. Among the special features of this machine is a pulling cylinder slide pioneered by this company. It provides a mass of weight which produces a balancing effect to the cutting tools. The result is a smooth, steady action which prolongs broach life and is conducive to fine finishes. Write for Circular VP9.

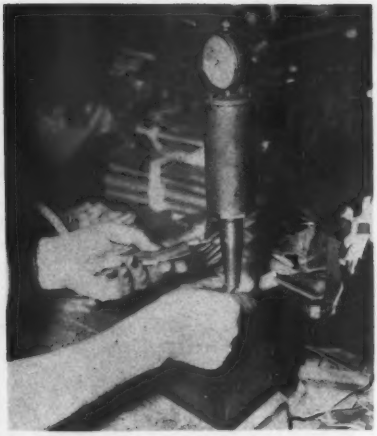


THE above photograph illustrates an unusual job of machine tool rebuilding and is indicative of the all-out conversion achieved by industry to speed the war effort. This planer, owned by the Vulcan Iron Works, was converted by the Simmons Machine Tool Corp., 1760 N. Broadway, Albany, N. Y., from 7' between housings to 13' 6" between housings. Simmons took this planer and, by providing a new rail and bridge, together with widening blocks between the housings and the bed, converted it to the desired length.

NOW that tools and machines must be operated at full capacity, the important factor of cleaning must not be overlooked. To speed this job, the Type DA Airduster has been developed by Paasche Airbrush Co., 1919 Diversey Parkway, Chicago, Ill. This rugged tool harnesses air power, which when released, dusts shavings, filings, chips and grit from metal parts, machines and tools. The body of the gun is brass and the handle affords a natural, easy grip. Bulletin F6-42A further describes this tool.

A NEW, light, inexpensive hand miller, suitable for handling light cuts in brass, aluminum and other materials, has been placed on the market by H. B. Rouse & Co., 2220 N. Wayne Ave., Chicago, Ill. It can be used speedily and accurately on small parts for radios, electric motors, etc. The spindle is adaptable so that either small circular milling cutters or small end mills may be used on the machine.





Comparator for Bomber Part Testing

THE Brewster Aeronautical Corporation's engineers have speeded up bomber part testing 400% by a device known as a Comparator, which operates in connection with a Rockwell Hardness Gage. Since every structural part of a bomber must be strength tested, the production time saved through this new device is tremendous.

The Comparator is comprised of a table-mounted yoke which supports a penetrator placed over an anvil. The die end of the penetrator is the same size as that used in the Rockwell Gage. The anvil moves upward against the penetrator under pressure of a piston operated by compressed air under 100 psi. A piece being tested is thus pressed against the spherical die with pressure sufficient to indent its surface. The depth of the indentation is shown by a Starrett Dial Indicator which records any upward motion of the die. The softer the metal, the greater the indentation.

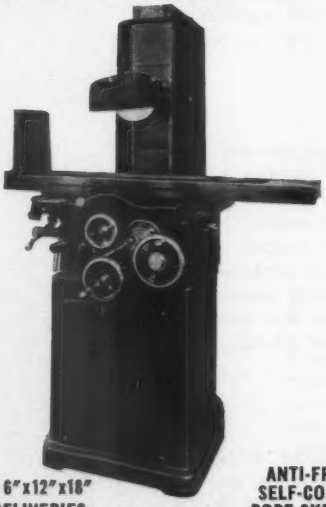
To test a number of similar parts, a part of correct hardness as determined by the Rockwell Gage is used to calibrate the Comparator. This piece is subjected to pressure in the Comparator at which time the position of the indicator needle is noted. Subsequent pieces, if of proper hardness, will give the same reading.

Compressed Air Institute, 49 Warrington Place, E. Orange, N. J., will send more details on request.

ATLANTIC

No. 2 Automatic Precision Type

SURFACE GRINDER



CAPACITY 6"x12"x18"
PROMPT DELIVERIES

ANTI-FRICTION
SELF-CONTAINED
POPE-SKF SPINDLE

ATLANTIC MACHINERY CORP.

149 Broadway New York, N. Y.

Metal-Cutting Saw Has New Table Assembly

THE Wallace No. 1-M Metal-Cutting Saw is shown here with a new cast iron T-slot table assembly to accommodate the holding of materials of irregular shapes or for clamping a vise or fixture in any desirable position.

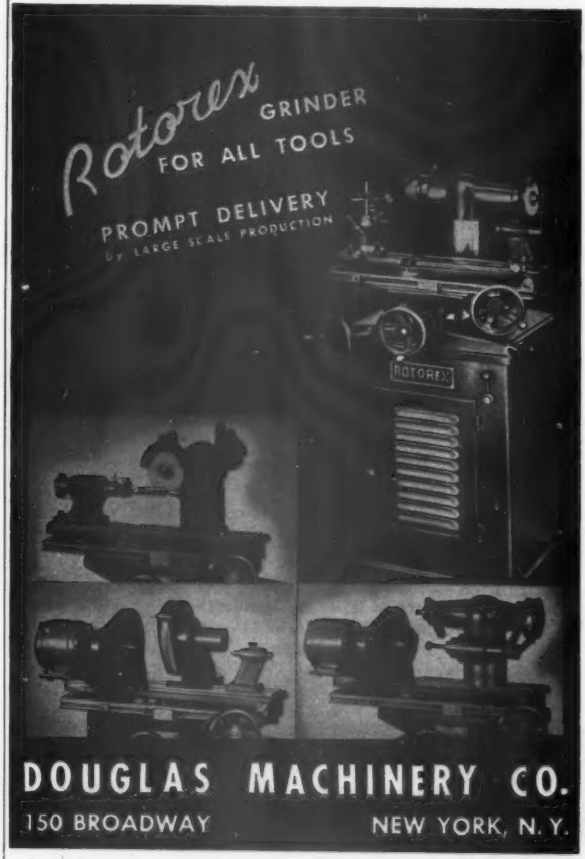
The column, arm and motor all rotate 360° and may be locked in any position for simple or compound angles or for ripping work. Stock is held stationary while the motor unit is pushed or pulled to make the cut.

Either saw blades or $\frac{3}{32}$" thick abrasive wheels are used for cutting, depending on the type of material to be machined. With the motor unit and blade or abrasive wheel sliding back and forth on the radial arm, this machine handles cut-off work on hard and soft steel, angle iron, brass, bronze, duralumin and aluminum, glass, plastics, brick, tile and other materials. Either single or three phase motors are available up to 2 hp.

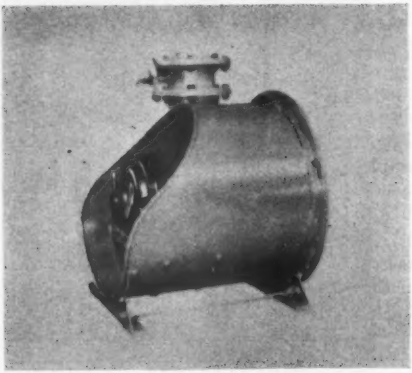
Bars, sheets, extruded sections, metal moldings, tubings, casting sprues and many other shapes and forms of material are accommodated by the optional table assemblies.

Sample materials for test cuts and recommendations may be submitted, without obligation, to J. D. Wallace & Co., 164 S. California Ave., Chicago, Ill. Bulletin No. 1-M is also available.

Be sure to read the interesting and informative article on Tolerance Control which starts on page 40, this issue.



Constant Air Pressure Possible With Turbo-Compressor



THE Spencer centrifugal type Turbo-Compressor is designed for delivering large volumes of low-pressure air to oil and gas-fired equipment, and for agitation, blowing and exhausting of air. The pressure delivered is constant regardless of the amount of air used. On a line with several individual furnaces, all the air valves may be opened or closed without affecting the pressure on the burners left on the line.

The outside casing is one piece, welded, securely held by end heads of special ribbed sections and spun rings. The motor is supported on a cast bridge that reinforces the unit and evenly distributes the weight. Light-weight impellers, mounted on extra large motor shafts, revolve at low peripheral speeds with wide clearances all around. There are no belts, gears or couplings. Friction losses are, therefore, negligible and because of its vibrationless features, can be mounted anywhere without special foundations. It is frequently placed on the side or top of the equipment it serves.

Standard Spencer Turbos are made in both single and multi-stage types for AC or DC operation at standard voltages and motor speeds. For special conditions, Spencer Turbos are available for gas-tight, acid or explosion-proof operation or with outboard construction.

For descriptive bulletin No. 127-J address The Spencer Turbine Co., Hartford, Conn.

Production time cut from

24 HOURS to 2 HOURS— with "HARDSTEEL" DRILL

"With a "HARDSTEEL" drill we now countersink more spring tempered steel trowel blades in two hours time than by former high speed steel countersinks in three 8-hour days — a saving of $12.10 in wages alone while the operator has 22 hours left to do other work", writes Otto Heydrich, tool maker.

You, too, can drill, countersink, counterbore and ream hardened steels, hardened parts, dies, armor plate and other materials — Rockwell "C" 40 and harder — and do it faster, better, and cheaper with "HARDSTEEL".

New shop practice is: — harden first — then drill — to avoid misalignment of holes at assembly caused by heat treat distortion.

You harden it — we'll drill it with "HARDSTEEL"

Write for literature

BLACK DRILL CO., 5005 EUCLID AVE., CLEVELAND, OHIO

HARDSTEEL DRILLS

REAMERS • TOOL BITS

Duo-Trol Regulates Current Flow Through Transformer

DUO-TROL is a combination of the National Weld Timer, plus heat control to regulate the current flow through the primary of the welding transformer. This is an important function and of particular value when welding alloy steel.

Ordinary taps in a welding transformer are sometimes coarse and the precise amount of current desired is often difficult to obtain. With National Heat Control the equivalent of 45 taps between each regular primary tap is obtainable. A rotating commutator-like cross segment, driven at 1800 rpm, closes the welding circuit every half cycle when it moves in line with a pair of carbon brushes in contact with its edge. Less current will flow through the transformer as the brushes are retarded.

It is rare for a welder to be set up for one job. Changes in timing and current must be made often and rapidly. To meet this demand for flexibility the finger tip dial set control was introduced. With the regular National Timer, weld-time is varied by moving one of its cams. The rocker arms are in a fixed position. It is easy but takes several minutes. A simple change in procedure was made in the Duo-Trol. Instead of moving a cam for weld-time setting, a rocker arm is moved around the cam with the same result.

Duo-Trol Bulletin No. 155-J is available from National Time & Signal Corp., 604 E. Milwaukee Ave., Detroit, Mich.

.0001"

It takes ZEROS to beat ZEROS

Checking a landing gear section with a Starrett Dial Test Indicator.

That's why Starrett Micrometers, Starrett Vernier Gages, Starrett Dial Indicators and hundreds of other Starrett Precision Tools are in the very thick of this fight.

Every man and woman in the Starrett organization is conscious of the importance of Starrett accuracy to the war effort and is doing the utmost to provide the tools and to put them in hands that count most heavily on the side of victory.

In meeting this objective your mill supply distributor is likewise contributing invaluable co-operation and service. We're back of him to the limit of our ability. Rely on him on all matters pertaining to procurement of essential precision tools.

THE L. S. STARRETT CO., Athol, Massachusetts, U. S. A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK

HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

New Device Used in Aircraft Instrument Marking

THE machine illustrated was specially built by The AcromarK Corp. to mark letters around the periphery of aluminum aircraft instrument parts adjacent to the position of each lug on the part.

An outstanding feature is the straight line holder which utilizes straight line standard type or dies that are economical to purchase and easy to space for precision marking. The type or die holder is constructed for easy changing of the type and dies and is arranged with provision for screw adjustment at the back of the holder for marking depth.

Die cast parts are equally simple to mark in this machine as well as parts of steel, brass and other materials and metals. A special mandrel holds the part as the slide carries straight line type past it, impressing the mark. A shaft from the mandrel extends into the base of the machine and is rotated by a rack beneath the slide that controls the mark and insures accuracy. A geared arrangement advances the slide as the handle is moved forward and a second part is marked on the return stroke. Mandrels can be made in any desired size to suit the parts to be marked and similar mandrels can be made interchangeable for the marking of a variety of parts.

The machine is compact and easy to operate.

Further information on this marking machine is available from The AcromarK Corp., 261 N. Broad St., Elizabeth, N. J.

FLATNESS and SMOOTHNESS
of Production Parts
The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.
Ultra-Lap MACHINE COMPANY
245 McDOUGALL AVE. · DETROIT, MICH.

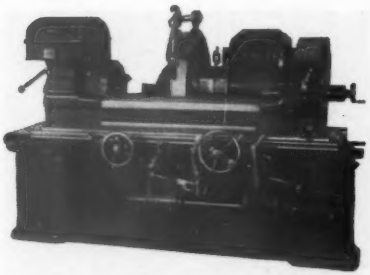
Micro-Finish Now Possible With Hill-Clarke Grinder

"SUPER Grinding" and "Micro-Finish" are two terms now being used by the Hill-Clarke Machinery Co. to describe the type of work produced on their line of grinders. Super grinding diminishes the peaks and valleys found in ordinary grinding to produce a micro-finished surface. Micro-finish is so perfect it must be measured in micro-inches —millionths of an inch. No extra grinding time is necessary for micro-finishing and it can be obtained with a coarse grain free-cutting wheel.

One feature, the patented multiple V-belt drive to work the spindle, provides the smooth, continuous rotation necessary for micro-finish and precision grinding. The grooved pinion and automatic idler, it is said, provide a powerful and positive drive. No manual adjustment is required to compensate for stretch in belts. A wide range of work speeds is instantly obtainable.

Accuracy and sensitive control of the wheel slide is necessary in producing duplicate diameters and holding them within precision limits. To make this possible, the nut and crossfeed screws are lapped to a very close fit.

A diamond holder of the foot-stock type is rigidly mounted and located enabling the operator to speed up wheel truing without removing the work and loss of time.



Direct inquiries to Hill-Clarke Machinery Co., 643 Washington Blvd., Chicago, Ill.

In holding, pressing, clamping, and forming operations, RACINE Variable Volume Pumps maintain any desired pressure from 50 to 1000 lbs. per square inch without wasting horsepower in by-passing oil and in oil heating. RACINE pumps only the volume of oil actually required by the circuit; it actually pays for itself in horsepower saved.

Unlike constant volume systems RACINE Variable Volume Pumps do not require by-pass and relief valves. When designed into your products they add reserve power and provide a definite competitive advantage.

RACINE Pumps are made in three sizes to give the maximum volume desired from 0 to 12, 20, 30 gallons per minute. Write for complete information and our catalog P-10-C. Our engineers will be glad to work with you on your hydraulic problems.

RACINE TOOL & MACHINE CO.
1768 STATE STREET · RACINE, WISCONSIN

Variety of Gears Finished with Single Cutter

THIS machine finishes gears of less than 4" diameter and less than 1" face width by the crossed-axis principle of gear shaving. Designed for mass production, it finishes gears for instruments, control mechanisms and similar precision devices in which high accuracy combined with correct tooth form are essential to successful operation.

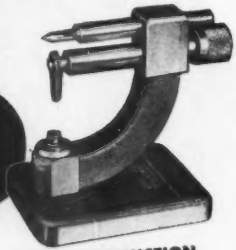
During the finishing operation the cutter moves across the face of the work. This cam controlled movement has a total travel of one inch. At the end of one lateral stroke the driving motor automatically reverses, turning the cutter and gear in the opposite direction. The entire cycle is automatically repeated at the rate of ten cycles per minute.

When the gear is finished the machine automatically stops. The operator unlocks and retracts the center with one movement of the control handle replacing the gear with another to be finished.

The machine permits the finishing of a wide variety of gears with a single cutter for each pitch and pressure angle. While 16 is the recommended maximum pitch, small gears of such pitches as 32, 48 and 64 have been successfully machined in tests on a production basis.

Complete specifications will be furnished by Michigan Tool Co., 7169 E. McNichols Rd., Detroit, Mich.

Something NEW YOU should KNOW ABOUT



• EASY TO OPERATE • SPEEDS PRODUCTION
• EXTREMELY ACCURATE • LASTS A LIFETIME

MAKE-ALL RADIUS DRESSER

not just another new tool, but a proven accurate time-saver for your simplified Male and Female Radius Dressing operations. Feature of the Make-All is simplicity of design that results in an unusual degree of accuracy for a radius dresser requiring no difficult calculations, depth gauges, micrometer or vernier setting. Send priority rating with your order for prompt delivery.

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

A special attachment accurately made, which with the use of Rattail Diamond Tools, will make full semi-circular radii as small as 0.035". Available at small additional cost.

$62.50 MAKE-ALL with one 60° GOLCONE Diamond Tool.

$72.50 MAKE-ALL with 60° GOLCONE, semi-circular radii attachment and Rattail Tool for 0.070" or larger radius.

Distributed by
Golconda Diamond Products Corp.
3856-58 NORTH ASHLAND AVENUE • CHICAGO, ILL.

Die Design and Detailing Time Saved with D-M-E Standards

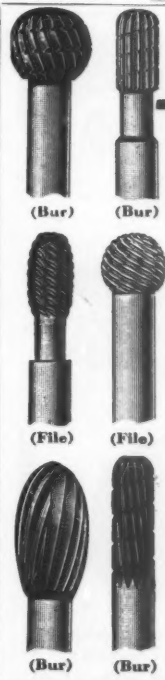
THE development of D-M-E Standards introduces a new idea in preparing dies for injection molding of plastics. Used privately for several years with remarkable success, the idea has been perfected to a point that the manufacturer was encouraged to put the device on the commercial market.

A saving is claimed through the reduction of time required for laying out the die design and detailing. A master drawing, supplied with each Standard, carries all the details of the D-M-E Standard. Thus, designing the base is eliminated and drawing in the cavities is expedited.

Because the design provides rigid support for the back-up plate through pillars, the likelihood of sagging or settling of cavities is eliminated. By having these plates non-reversible, there is no danger of having them come together in such a way as to ruin the cavities.

All parts are jig-drilled, making them interchangeable and permitting their replacement out of stock. A D-M-E Standard comprises a complete die set ready for cavities, injector pins and water lines.

Further details may be obtained from Detroit Mold Engr. Co. Direct inquiries to The TOOL & DIE Journal, 2460 Fairmount Blvd., Cleveland, O.



MARTINDALE ROTARY FILES and BURS

Made from High Carbon Steel or High Speed Steel these accurately cut Files and Burs are available in 300 sizes.

Orders are usually shipped within 6 days after being received.

Write for 12-page Bur Bulletin.

THE MARTINDALE ELECTRIC CO.

1417 Hird Ave.

CLEVELAND, OHIO

Drilvise Permits Use of Both Hands in Operation, Setup and Removal of Work

JUST announced by the Studebaker Machine Co. is a new Drilvise designed for holding work on the table of all types of drill presses, planers, shapers, milling machines, surface grinders, lathes, cut-off saws and other machines.

Entirely foot controlled and hydraulically operated, this new tool permits the use of both hands in the operation, setup and removal of work from the machine on which it is mounted. Exceedingly powerful, exerting in excess of 10,000 psi pressure between jaws, the Drilvise is self-sufficient, requiring no outside power or air supply. The unit consists of a conventionally-shaped drill press vise and hydraulic foot control base.

The Drilvise is entirely safe in operation. Fingers cannot be crushed as only the rear jaw is movable. The work-holding pressure movement of the jaw is controlled by the operator's foot and then in a maximum of $\frac{1}{16}$" advances for each downward movement of the pressure foot pedal. There are no sudden pressure snaps of uncontrolled movements of the jaws.

Jaw faces are aligned for .001" accuracy. Cross slots and side ears are provided so that the Drilvise can be bolted either lengthwise or across the work table. Hydraulic parts, sliding jaws and bearings are machined for accuracy and precision operation.

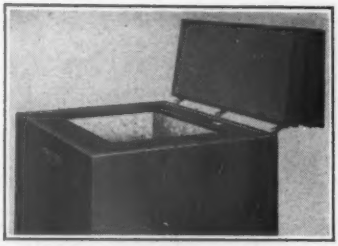
Complete information and literature may be obtained from Studebaker Machine Co., 19 S. Clinton St., Chicago, Ill.

The Jackson No. 2 Verticle Milling Machine, ruggedly built of quality materials, will prove indispensable for Tool Room or Production applications. 5 speed V-belt drive, sturdy 4¼" quill and ¾" spindle capacity 8" x 32" table.

JACKSON
MACHINE & TOOL COMPANY SALES DIVISION
956 Roberts St. Jackson, Michigan

Revco Sub-Zero Equipment Prolongs Gage Life

SINCE tool rooms and die shops must age their precision gages to prevent growth and thus prolong the life of the gage, sub-zero chilling is constantly finding increased applications in war industries. Revco offers new accuracy and precision in the testing and calibration of aviation materials. Revco sub-zero equipment is durable, rugged and dependable for the severe industrial uses encountered. Sizes in the following models are available: SZ-15, 1.5 cubic feet; SZ-30, 3.0 cubic feet; SZ-70, 7 cubic feet.



Further information on the Revco line of industrial Chill Chests may be obtained by writing Revco, Inc., Dept. 4R, Adrian, Mich.

Seasoning of carbon vanadium steels is standard practice in many advanced tool rooms and die shops. The making of chill shrinks fits is gradually finding increased applications. The aircraft industry uses large quantities of rivet storage cabinets to hold aluminum alloy rivets down to —50° F to prevent hardening before driving. This same aircraft industry and allied suppliers must test the many gages, instruments, hydraulic controls, transmission tubes, lubricants and fluids at —50° F to —75° F.

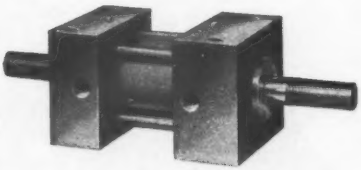
Three big reasons why the October issue of The Tool & Die Journal should be on your "must" see list.

National Metal Show in print.

New Cover.

Square back binding.

on T·J HYDRAULIC CYLINDERS



- **The mounting surfaces are parallel with (or at right angles to) the bore of the cylinder.**
- **All surfaces are as square and as smooth as is warranted.**
- **All mounting holes are drilled—not just cored.**

This workmanship makes for better installation, admirable appearance on the job and what is better yet, of course, insures a longer life of more efficient performance. Catalog H-40 sent promptly on receipt of your request.

this is a TOMKINS-JOHNSON *product*

630 North Mechanic Street Jackson, Michigan

Hardsteel Tool Bits Efficient, Inexpensive

A NEW line of tool bits, for machining hard, tough steels and the copper or aluminum alloys, are made of the same metal that has proved its value to industry in the well-known, patented Hardsteel drills and reamers.

Hardsteel tool bits fit admirably into the present war production program wherever lathes, boring mills, shapers and planers work on steels such as the 4100 series, the high chrome, high nickels and high speed tool steels. They are especially suited to work on heavy forgings where deep rough cuts can be made at faster cutting speeds. Excellent results, however, are achieved when used as finishing or forming tools. They cut down scrap loss on many critical metals.

Two other factors make these tool bits inexpensive in use. They can be reground on an ordinary wheel time after time. But, because they take abuse and operate efficiently at red heat, they need less regrinding.

The illustration shows two ⅜" Hardsteel tool bits, ground as fly cutters to remove metal from both sides of the hole as the work revolves, mounted in a boring bar to cut a 2¼" hole in full hardened 3140 nickel chromium steel links for conveyor chain.

The Black Drill Co., 5005 Euclid Ave., Cleveland, O., will send further details at your request.

Our Services

Flame Hardening · Annealing · Aerocasing · Bar Stock Treating and Straightening · Heat Treating · Pack or Gas Carburizing · Sand Blasting · Chapmanizing · Tempering · Cyaniding · Nitriding · Hi-Speed Hardening

METAL TREATING INSTITUTE

THE LAKESIDE STEEL IMPROVEMENT CO.

5418 Lakeside Avenue CLEVELAND, OHIO Phone Henderson 9100

Internal Grinder for Die Work

THE Abrasive No. 1G has been developed to handle work requiring a highly accurate, easily handled internal grinder. It is especially adapted for die work, particularly that used in bullet and cartridge manufacture.

This machine will grind holes from ¼" to 12" diameter; has a longitudinal travel of 8" and spindle cross feed of 3½". Longitudinal feed has graduated hand wheel .001" and positive stop with micrometer adjustment. These close graduations, plus the rapid acting draw-in collet and the quick operating hand feed, make the No. 1G an extremely handy and accurate machine. It can be also used for external or cylindrical grinding within its capacity.

The work spindle, mounted on precision ball bearings, is graduated and swivels to enable grinding tapers up to 90° included angle. The work spindle has 4 speeds—76, 145, 282 and 540 rpm.

The Abrasive internal grinder has a Dumore ½ hp motor driven precision wheel spindle having a range of 6 speeds—4500, 6500, 14600, 32500 and 42500 rpm to take care of grinding wheels ⅛" up to 5" diameter. Full load speed of motor is 10,000 rpm.

Abrasive Machine Tool Co., Dept. A9, East Providence, R. I., will send descriptive literature at your request.

LINCO Two Spindle
ADJUSTABLE
DRILL HEADS
DRILLS TWO HOLES AT ONCE
Adjustable Centers from ½" to 6"
Drill Capacity 0 to 5/8"
Sleeve and overarm types . . . in several sizes. Will double output of any single spindle drill press.
Quickly adjusted to desired drill centers from ½" to 6".
Send for bulletin.
LINDERME MACHINE & TOOL CO., INC.
12250 COYLE AVE., DETROIT, MICH.

(Continued from Page 88)

operations. The driver may be suspended by means of a cord and a screen door spring directly over the work area. It is always in the same place and the operator can reach for it accurately without looking. When finished with it, he merely lets go and thus saves the second required to put it down. Such a small saving in time has a remarkable effect upon the production rate.

Sticking plastics parts together by means of cements or solvents is an often-used method of assembly. Cements are used as thermosetting materials are not subject to solvent action. Thermoplastics may be softened by solvents and then pressed together. Cements which produce the most rapid drying, strongest joint or a joint which will have the least amount of odor after drying are used for thermoplastics. Ten percent of the thermoplastics being cemented is dissolved in a combination of one or more solvents to produce this cement.

When cementing thermosetting materials, good results may be obtained by applying the cement to the porous interior portion of the molding rather than on the polished molded skin. When cementing thermoplastics material the solvents must be given time to bite into the surfaces to be joined. For this reason the solvent must not be too volatile or it will dry before softening the surfaces sufficiently.

Before a cemented joint is specified for a plastics assembly, service conditions must be considered carefully. For example, the high temperature encountered in the interior of a closed automobile in summer may cause the cementing solvent to evaporate and condense on or etch a polished surface inside the part where it cannot be repolished. Heat, humidity or severe vibration may cause breakage of cemented joints. Tests should approach as nearly as possible the service conditions expected in order to check for unforeseen difficulties.

Painting

A wide variety of painting operations for decorative purposes is met in the finishing department. The simplest of these is perhaps the use of wipe-in lacquer for lettering or for depressed designs. Spray-

FLOATING HOLDERS for Screw Machines

Now Available for
IMMEDIATE DELIVERY
(In Stock)

	Our No.	
B & S No. 00	No. 1	$6.00
B & S No. 0	No. 2	6.25
B & S No. 1	No. 3	7.95
B & S No. 2	No. 4	8.65

Made of Forged Steel
as developed by our Engineers

(Designers and Builders of Fine Machine Tools)

AJAX ENGINEERING & MFG. CO.
MANUFACTURERS OF HALCO PRODUCTS
14230 BIRWOOD AVE., DETROIT, MICH.

ing through stencils and spraying overall are also two painting methods often employed.

Wipe-in lacquers are brushed over the area to be filled and then the lacquer allowed to dry until the action of wiping the excess from the polished surface will not disturb the lacquer in the depression. Cleaning the polished surface is accomplished with a cloth slightly moistened with solvent. This method may be applied to nearly all types of plastics, although some care is required in applying and in wiping excess paint from thermoplastics so that the cloth is not wet enough to etch the surface.

Spray painting with lacquers, drying oil paints and enamels is done in safety booths. The lacquers dry quickly in air while enamels are often dried in infra-red drying ovens. These ovens consist of several banks of lamps which produce the hot infra-red radiation in an evenly distributed pattern. A conveyor may be run past these banks of lights and the painted moldings are then carried past on racks built especially to suit the part being carried. Such equipment is rather expensive but worthwhile when a variety of colors in large volume are desired and a low priced plastics can be used. The increased cost of colored plastics will be more expensive than the equipment mentioned above. Baking enamels produce hard, durable, good appearing finishes. Thermoplastics will not stand the heat of drying in this manner if the higher temperature drying oils are used.

Large volume enameling or lacquering often warrants conveyorized automatic spraying equipment. This may be special for a single job if it's large enough, or adaptable to many kinds of moldings by building new fixtures for each job.

The finishing of plastics moldings constitutes a large proportion of the work of the completed piece. Finishing methods and equipment, therefore, should be given full consideration when estimating and planning to produce a molded part. If finishing equipment is not designed and built along with the mold, delays may arise, causing finely calculated schedules to be disrupted.

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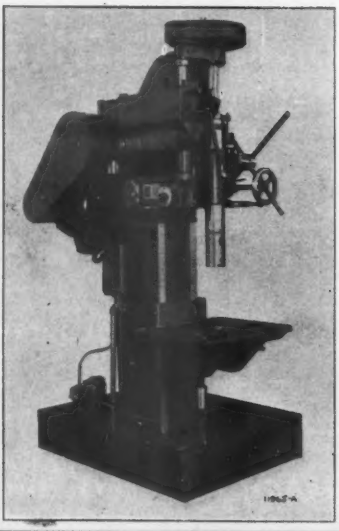

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(Continued from Page 51)

for any man whose immediate going into the armed services would retard production of vital war material or other services essential to the war effort, or who is needed to maintain national health, safety and interest.

Only when an employee is working in a critical occupation within an essential industry should a Form 42A be filed for his temporary occupational deferment.

Make Replacements

Yes, an inventory within a man's own plant is called for; also an appraisal and analysis of the manpower in the community. There is many a man over 45, or a man physically handicapped, or a woman who can do that job that the 23-year-old boy is doing who took a 12-week course at a learn-quick school.

There are not more than sixty million people in this country who are capable of effective productive effort. These men and women represent our total manpower available to win the war. They must do everything that must be done in a total war; maintain transportation, communications and utility systems, maintain public services, grow food for ourselves and our allies, mine the metals and produce the raw materials, fabricate and produce the amount of consumers goods necessary to maintain even a restricted national life and the supplies, weapons and munitions of war; also most of all they must provide the men who land on strange shores in far places, the men who carry the fight to the enemy on a multitude of far-flung frontiers. The rest of the population who mine raw materials and produce the weapons with which these men fight must be a self-disciplined team working in unity. The individual personal convenience, comfort or pleasure, or the convenience and ordinary leisurely placement programs of the employer, will have to be given progressively less consideration as the war gets tougher and the casualty lists grow.

When we hear of the big armies we are going to raise, we must all remember that it takes at least five men or women to produce what they eat, use, fight with, and wear. With less than sixty million availables in this country, those figures are worth deep consideration.

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20 inches away from table, 8 inches off center.

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This new award, given in recognition of outstanding production records, supplants the Navy "E" and the Army-Navy Star.

The Putnam Tool Company of Detroit, makers of Hi-Speed End Mills, were chosen for this signal honor for their outstanding contribution to the war effort. Ernest Putnam, President of the company, was a pioneer in tackling difficult Government jobs long before Pearl Harbor. His organization's continuous effort fully justifies this honor the Army and Navy have given him.

The Simmons Machine Tool Corp., Albany, N. Y., was the first company to receive the joint award for rebuilding machine tools. In making the formal presentation of the flag, Captain E. D. Almy, U. S. Navy, said, "The question of repair and conversion of used tools has been of paramount importance throughout the defense effort, and now in the war effort. Any tool in reasonable condition can, if properly reconditioned, be restored to its original tolerance. In many cases an old tool can be greatly improved in operation and ease of control. Therefore, used tools have been vital to our war effort. The 40,000 used tools placed in production lines in 1941 have been of untold value."

Other plants similarly honored were: Blanchard Machine Co., Cambridge, Mass., manufacturers of rotary surface grinders; Ex-Cell-O Corporation, Detroit, Mich., makers of high precision machines and cutting tools; Kearney and Trecker Corp., Milwaukee, Wisc., milling machine manufacturers; National Twist Drill & Tool Co., Detroit, Mich., twist drill and small tool makers; Builders Iron Foundry, Providence, R. I., surface grinder builders; and Armstrong Bros. Tool Co., Chicago, Ill., makers of tool holders.

To these companies and to the many other Army-Navy "E" recipients our heartiest congratulations. For the exemplary production feats you have achieved in the past and new records you will ring up in the future, the whole country is cognizant of the part you are playing in our war effort.

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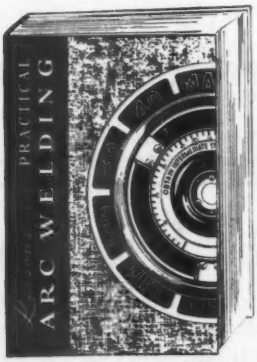

PRACTICAL MECHANICS HANDBOOK—The author of this 400-page volume has assembled tabular matter most often referred to by men engaged in the mechanical trades. Some of the many subjects covered are: lathe, small tools, filling, fitting and marking out, micrometer and vernier, mensuration, screw and gear cutting, hardening and tempering, chemical coloring of metals, electro-plating, silver soldering, brazing, welding, soldering aluminum, pattern making, polishing and finishing metal. This book has a fully cross-referenced index to enable readers to quickly trace the information they seek. It is believed that mechanics, engineers and draughtsmen will find this a valuable reference book. Written by F. J. Camm, Price $4.00.

THE STEEL HANDBOOK—No. 42—is the wartime edition for machine tool users. The sole purpose of this handy reference book is to promote efficiency in machine tool operation. It contains data and information to aid the steel user in selecting the right steel for the right purpose and in securing highest efficiency in its production processes. Completely indexed this pocket-sized book contains conversion tables, steel specifications, surface cutting speeds as well as tool speeds and feeds, estimating tables, allowances and tolerances for screws and nuts and many more practical reference sheets. Copies sent free of charge if request is made on company letterhead and addressed to Union Drawn Steel Div., Republic Steel Corp., Dept. T-9, Massillon, O.

THE CARE AND OPERATION OF A LATHE—published by the Sheldon Machine Co., Inc., 4236 N. Knox Ave., Chicago, Ill., builders of Sheldon Lathes, is a pocket-size, paper covered manual written for the apprentice or student machinist. It illustrates and explains: the modern back-geared, screw cutting lathe; its parts and functions; oiling and proper care of a lathe; the grinding of cutters; modern lathe tools; holding the work; and the performance of basic lathe operations. This manual is well illustrated and exceptionally complete in its tool grinding charts. Price, single copies, 30c. Discounts for schools or other quantity buyers.

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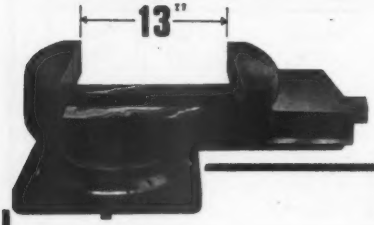

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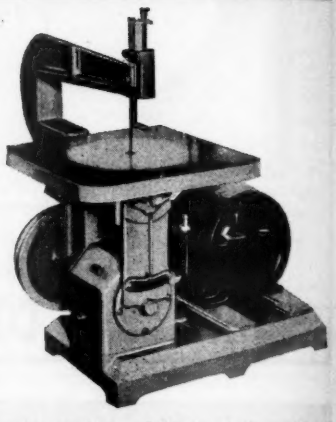

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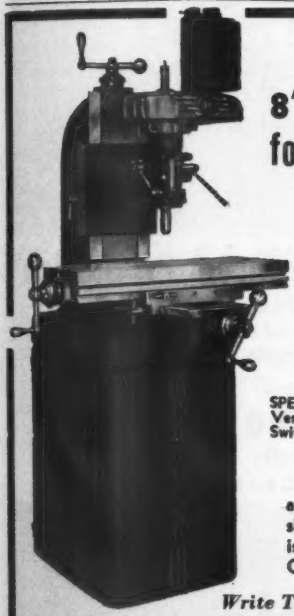

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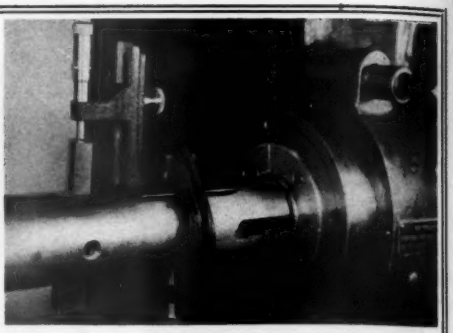

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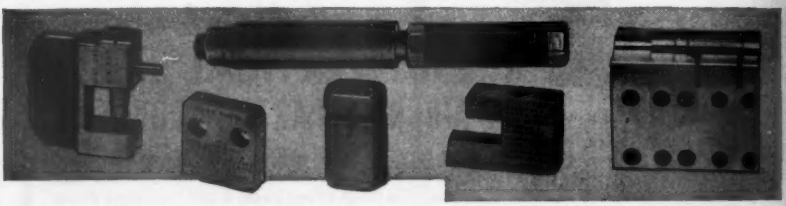

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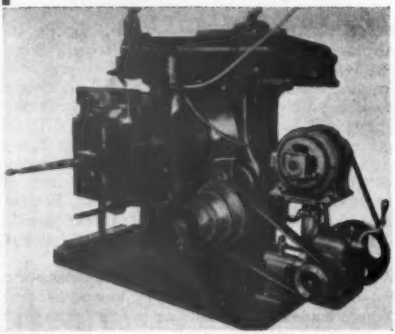

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NEW 20-PAGE CATALOG—just published by the Ex-Cell-O Corp., Detroit, Mich., illustrates and gives complete specifications on its entire line of precision machine tools, cutting tools and related products. A copy of this catalog—No. 27121—is available to all interested.

C-F POSITIONERS—Bulletin WP 22 is an informative and well illustrated bulletin describing the new practice of welding on positioners. Its 16 pages are devoted to typical welding jobs with descriptions of position welding methods. Just off the press, Bulletin WP 22 is being distributed without charge to those requesting it on their company letterhead by Cullen-Friestedt Company, 1316 S. Kilbourn Ave., Chicago, Ill.

TCM FOR HIGH SPEED PRODUCTION — A 12-page book describing the new Jessop TCM High Speed Steel has just been published by Jessop Steel Co., 600 Green St., Washington, Pa. Information regarding its advantages and performance as compared to 18-4-1, its analysis, typical applications and heat treating procedure, are covered in detail.

WILLEY'S DIAMOND WHEEL DRESSING TOOLS—Bulletin WC describes and illustrates both the Torpedo Type and Single Diamond Type Dressing Tools manufactured by Willey's Carbide Tool Co., 1340 W. Vernor Highway, Detroit, Mich. Complete specifications and prices are included.

THE DIAMOND WORLD—Facts about industrial diamonds which will prove of interest to tool room and die shop men are contained in Bulletin 48. To help locate the world's largest diamond producing districts, Christensen has reproduced a colored map for quick reference. The group mount and cluster type tools are illustrated and described. Send for your copy of this booklet. Address Christensen Diamond Tool Co., 3688 E. Willis, Detroit, Mich.

PRECISION PRODUCTION TOOLS—This brochure, profusely illustrated, describes in detail a great variety of precision production tools. Complete specification and prices are given. Catalog No. 42 will be sent by Acme Tool Co., 200 Church St., New York, N. Y.

INDEX MILLS—are definitely in the victory program, making parts for airplanes, tanks, guns, submarines, periscopes, and machine tools. Bulletin No. 6 contains pertinent data on the Index Mills manufactured by Blank & Burton Machinery Co., 3101 E. Michigan Ave., Jackson, Mich. Illustrations and a long list of users of Index Mills are included.

ENGINEERING AND APPLICATION DATA—Form No. 2008-A describes and illustrates the versatile line of overhead materials handling equipment manufactured by Cleveland Tramrail Div., The Cleveland Crane & Engineering Co., Dept. J-6, Wickliffe, O. Of special interest will be the chart and examples which explain how to figure costs. Form No. 2008-A is available at your request.

ADJUSTABLE V-BELTS—An attractive booklet issued by Manheim Mfg. & Belting Co., Manheim, Pa., contains a graphic story of improved machine operation with Veelos—the adjustable V-belt. Photographs depicting actual shop conditions and remedies and concise, explanatory captions make this booklet of interest and value to the busy tool and die shop man. Ask for Booklet V. It will be sent promptly.

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(Continued from Page 96)

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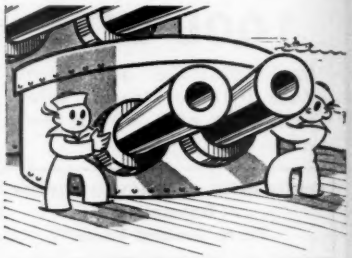

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• Genuine Java Water Buffalo Hide replaceable faces in malleable head.

No.	Dia. in ins.	Wgt. in lbs.
0	1	½
1	1¼	1⅛
2	1½	1⅝
3	1¾	2¼
4	2	4
5	2¾	5½

• A finely balanced Tool with tough, resilient Java Water Buffalo Rawhide heads.

Not Loaded				Loaded Mallets			
No.	Dia. ins.	Lgt. ins.	Wt. Ozs.	No.	Dia. ins.	Lgt. ins.	Wt. Ozs.
0	1	2⅛	2	7	1¼	3	8
1	1¼	3	3½	8	1½	3⅛	12
2	1½	3¼	6	9	1¾	3⅝	16
3	1¾	3¼	7½	10	2	3½	20
4	2	3½	10	11	2¾	4¼	42
5	2¾	4¼	21				
6	2¾	4¾	23				

• These are the tough, resilient, long-lasting Rawhide faces made from specially treated Java Water Buffalo hide for use in Chicago Rawhide Hammers.

CHICAGO Rawhide MFG. CO.

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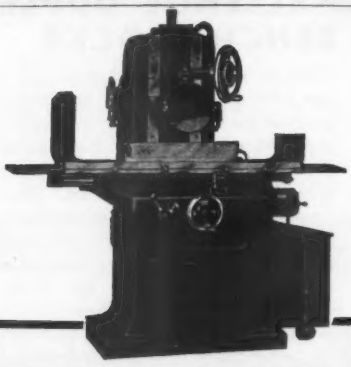

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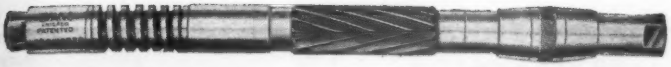

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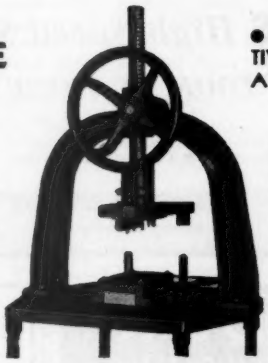

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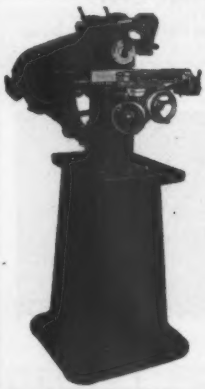

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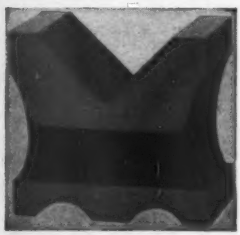

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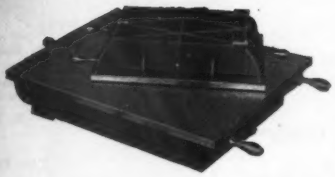

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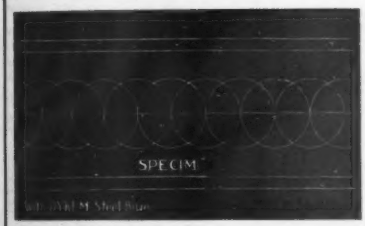

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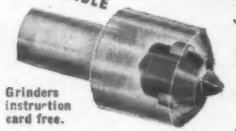

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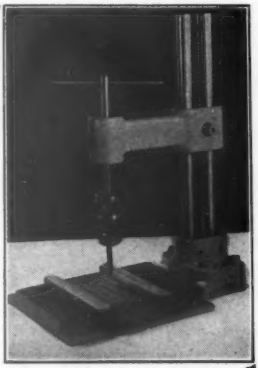

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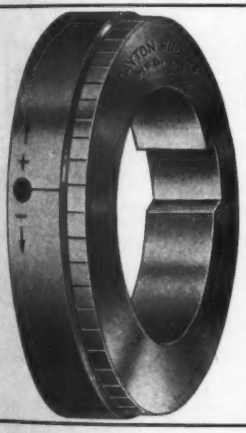

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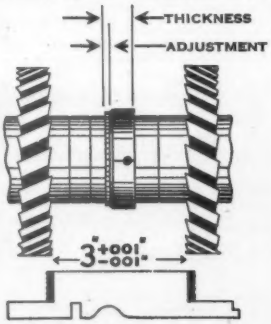

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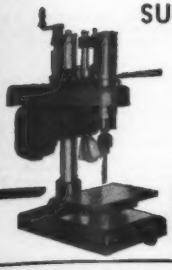

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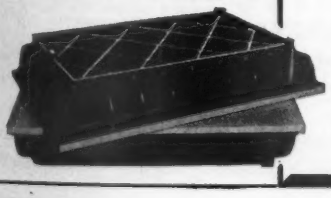

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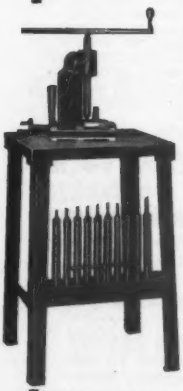

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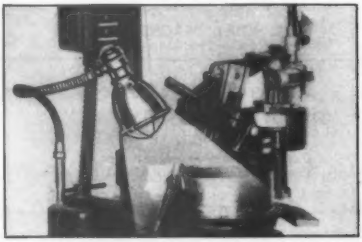

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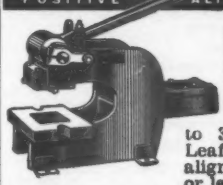

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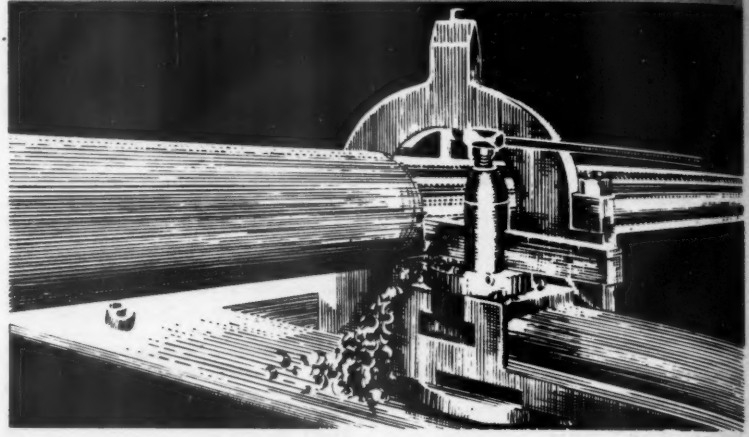

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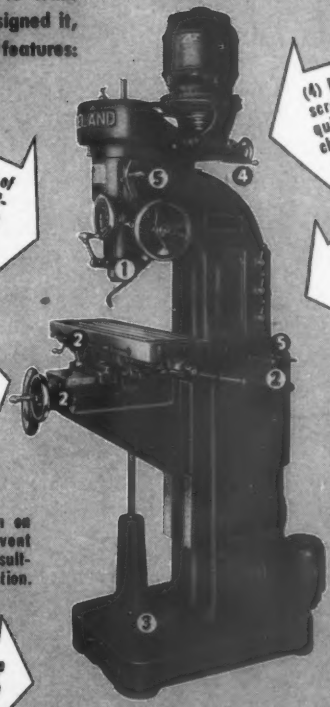

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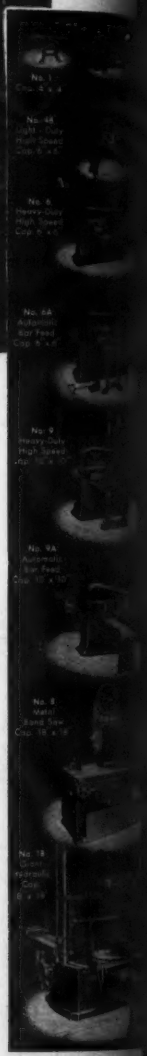

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